THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

[Registered as a Newspaper.]

Vol. XXIX. No. 724.] LONDON, MARCH 27, 1877. [29th Year.] Price 6d.

RAMSAY'S NEWCASTLE CANNEL COAL. Analysis—12,000 cubic feet of gas per ton of coal; 28-candle gas; coke, 66·70 per cent.; volatile matters, 33·30 per cent. Coke of good quality.

RAMSAY'S PATENT CONDENSED GARESFIELD COKE.

RAMSAY'S ORDINARY GARESFIELD COKE.

RAMSAY'S FIRE-CLAY ARTICLES.

GAS-RETORTS, introduced 1828. FIRE-BRICK WORKS, established 1804. FIRE-CLAY SANITARY PIPES, CHIMNEY-TOPS, and all Goods made of Fire-Clay. The Fire-Clay is worked from Blaydon Main Colliery, is of excellent quality, and no expense spared in perfecting every article. The FIRE-BRICKS (marked "RAMSAY") are to be seen in all parts of the world, and the Works are the most extensive in the Kingdom.

Manufactories—Derwentaugh, Swalwell, and Hebburn Quay, near Newcastle-on-Tyne.

Address G. H. Ramsay, Newcastle-on-Tyne.

GENUINE TORBAY PAINT
AND
SPECIAL GASOMETER PAINT.

Four Prize Medals. Established over 20 Years.

These Paints are now used in 150 Country Gas-Works, and by all the London Gas Companies, on Gasholders, Scrubbers, Purifiers, &c. They will cover tar effectually. Also used by the Admiralty, War Office, Railway Companies, Founders, &c.

They prevent and arrest rust, and protect iron from the action of water, sulphurous and gaseous exhalations.

The covering powers are considerably greater than those of any other Paint.—*See "Engineer," Nov.* 2, 1866.

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(Successors to Samuel Calley.)
21, GT. WINCHESTER ST., LONDON.
Works: BRIXHAM, TORBAY.

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BROOKFIELD WORKS,
203, ICKNIELD STREET EAST, BIRMINGHAM,
MANUFACTURER OF
WOOD GRIDS
FOR
SCRUBBERS & PURIFIERS.
CONTRACTOR FOR
LAYING MAINS & ERECTING APPARATUS.
Light Steel Charging Coal and Coke Shovels, Charging Scoops, &c., &c., supplied promptly.

COWEN'S PATENT FIRE-CLAY RETORTS.
JOSEPH COWEN and CO.,
BLAYDON BURN, BLAYDON-ON-TYNE,
Were the only parties to whom a Prize Medal was awarded at the Great Exhibition of 1851, for "Gas-Retorts and other Objects in Fire-Clay," and they were also awarded at the International Exhibition of 1862, the Prize Medal for "Gas-Retorts, Fire-Bricks, &c., for Excellence of Quality."

J. C. and Co. have been for many years the most extensive Manufacturers of Fire-Clay Retorts and Fire-Bricks in the Kingdom. Orders for Fire-Clay Retorts of all shapes and dimensions, and to fit any shaped Mouthpiece, Fire-Bricks, and every other article in Fire-Clay, are promptly executed at their Works as above.

COWEN'S GARESFIELD COALS.
Coal Office,
Quay Side, Newcastle-on-Tyne.
Jos. Cowen & Co. are the only Manufacturers of Fire-Bricks and Clay Retorts at Blaydon Burn.

JOHN RUSSELL AND CO.,
LIMITED,
Established at the commencement of Gas Lighting.
Branch Establishments:
69, UPPER THAMES STREET, E.C.;
4 & 5, CHARLES STREET, SOHO;
16, SOHO SQUARE, W.;
48, GREEK STREET, SOHO SQUARE;
83, COMMERCIAL ST., SPITALFIELDS;
} LONDON.
35, 36, 37, & 39, GRANBY ROW, MANCHESTER.
16, ELLIS COURT, AIRE STREET, LEEDS.
Manufactories:
ALMA TUBE WORKS, WALSALL, AND
THE OLD PATENT TUBE WORKS, WEDNESBURY.
J. R. & Co., Ld., are the original manufacturers of Wrought-Iron Gas Tubes and Fittings, and Inventors of the LAP-WELDED TUBES for Locomotive and Marine Boilers.
J. R. & Co., Ld., make all kinds of Tubes and Fittings for Gas, Steam, and Water; Gun-Metal Cocks, Stocks, and Dies; Galvanized Tubes and High-Pressure Tubes, &c.
Lists may be obtained on application to
Head London Office:
145, QUEEN VICTORIA STREET.
Head London Warehouse:
234, UPPER THAMES STREET, LONDON, E.C.

JOHN BENT & SON,
BELL BARN ROAD, BIRMINGHAM,
MANUFACTURERS OF
WET AND DRY GAS-METERS,
OF
FIRST-CLASS MATERIALS & WORKMANSHIP;
Also, STATION-METERS, PRESSURE-GAUGES, STREET-LAMPS, REGULATORS, &c.
Established 1836.

THOMAS PIGGOTT & CO.,
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MANUFACTURERS OF
TELESCOPIC & SINGLE GASHOLDERS,
CAST & WROUGHT IRON TANKS FOR DITTO,
And Gas Apparatus of every Description.
Marine, Tubular, Cornish, Plain, Furnace, Saddle, and Range Boilers.
Sugar, Saltpetre, and all kinds of Pans.
Roofs, Girders, and Bridges, and General Smith's Work.
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J. & H. ROBUS,
BUILDERS AND CONTRACTORS
FOR THE
ERECTION AND REBUILDING OF GAS AND WATER WORKS.
ESTIMATES FREE
FOR MAIN-LAYING AND GENERAL REPAIRS.
RETORT-SETTING A SPÉCIALITÉ.
ROBUS'S IMPROVED RETORT-SETTINGS guaranteed to carbonize a large amount of coal with a small per cent. of fuel.
N.B.—All kinds of Fire Goods, &c., kept in stock for immediate delivery. Orders promptly attended to.
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CANNEL COAL.

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PATENTEES OF THE

NATIONAL STANDARD GASOMETERS

FOR THE ENGLISH GOVERNMENT
AND FOR THE GOVERNMENT OF THE NETHERLANDS
AND OF THE DUPLICATE COPY
Presented by Her Majesty's Government to the French Government,
AND MANUFACTURERS OF
IMPROVED DRY GAS-METERS
Warranted to Measure correctly & not to vary.

RANELAGH WORKS, RANELAGH ROAD, PIMLICO, LONDON, S.W.
236, GEORGE STREET, GLASGOW, & 30, LANCASTER AVENUE, MANCHESTER.

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A. FAAS & CO., FRANKFORT O/M. | COPLAND & McLAREN, MONTREAL.
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JOSEPH AIRD,

WELLINGTON TUBE-WORKS, TIPTON, STAFFORDSHIRE,

MANUFACTURER OF

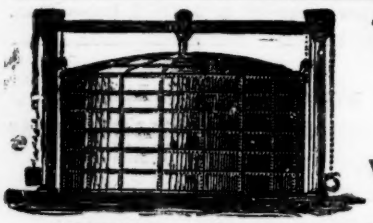
EVERY DESCRIPTION OF TUBING, GAS, STEAM, HYDRAULIC TUBES AND FITTINGS, EITHER BLACK, GALVANIZED, OR ENAMELLED HOT WATER TUBES AND FITTINGS, CORE BARS, COILS, COCKS (IRON OR BRASS), CHANDELIERS, &c., GAS-FITTERS' TOOLS, GAS TONGS, STOCKS, TAPS, DIES, &c., &c., HANDRAIL TUBINGS, IRON AND BRASS, PLAIN OR TWISTED, TELEGRAPH TUBES OR POLES, &c., &c.

LAMBERT BROTHERS, WALSALL.

ALPHA TUBE & FITTING WORKS

Manufacturers of **W. J. WARNER'S PATENT MARKET GAS STAND-PIPE.**

Now ready, GAS CHANDELIER BOOK (Reduced Prices), 7s. 6d.



W. C. HOLMES & CO.,

WHITESTONE IRON-WORKS, HUDDERSFIELD

MANUFACTURERS OF

RETORTS, ANNULAR AND PIPE CONDENSERS,

WROUGHT AND CAST IRON SCRUBBERS, PURIFIERS, GASHOLDERS,

GOVERNORS, AND ALL THE NECESSARY FITTINGS FOR COMPLETING THE ERECTION OF GAS-WORKS.

STATION & CONSUMERS WET OR DRY METERS, STREET & SERVICE MAINS, LAMP COLUMNS & BRACKETS, & WROUGHT-IRON TUBES AND FITTINGS; WROUGHT-IRON ROOFS FOR ANY SIZE OF BUILDINGS.

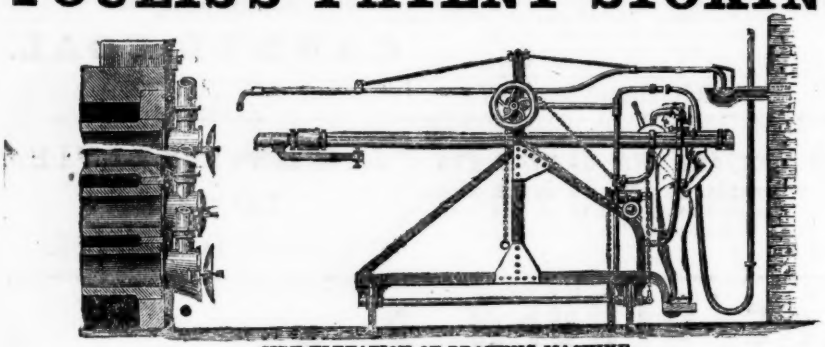
Sole Makers of B. W. Thurston's Combined Condensing, Scrubbing, and Washing Apparatus,

AND PATENTEES OF THE IMPROVED COMBINED CONDENSING AND PURIFYING APPARATUS SO EMINENTLY ADAPTED FOR EXPORTATION.

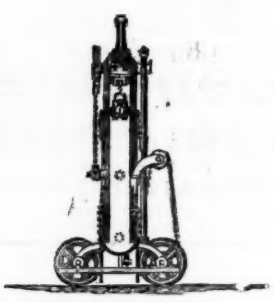
REFERENCES TO UPWARDS OF 300 GAS-WORKS.

LONDON OFFICES: 92, CANNON STREET.

FOULIS'S PATENT STOKING MACHINE.



SIDE ELEVATION OF DRAWING MACHINE.



END ELEVATION.

(The Charging Machine will be Illustrated in next week's Advertisement.)

Makers: TANGYE BROTHERS and HOLMAN, London and Birmingham; ADAM WOODWARD and SON, Manchester; ROBERT LAIDLAW and SON, Glasgow; MASCHINENBAU-ACTIEN-GESELLSCHAFT HUMBOLDT, Kalk bei Deutz:

Or all particulars may be had from JAMES WOTHERSPOON, 31, St. Vincent Place, Glasgow.

Established

1795.

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THE ORIGINAL

WORTLEY FIRE-BRICK WORKS,

NEAR LEEDS,

London Wharf: No. 4, inside Great Northern Goods Station, King's Cross, N.;

LIVERPOOL: Back Leeds Street.

SPECIAL NOTICE.—Our Patent Machine-made Retorts have now been in *actual work* nearly 800 days, and are yet in good order. References on application.

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GLOBE TUBE-WORKS, WEDNESBURY; & VICTORIA TUBE-WORKS, GREAT BRIDGE, STAFFORDSHIRE,

MANUFACTURERS OF

PATENT WELDED WROUGHT-IRON TUBES,

FOR GAS, STEAM, AND WATER;

GAS-FITTERS TOOLS, STEAM COCKS, AND ALL KINDS OF JOINTS.

HYDRAULIC TUBES, CORE BARS, TELEGRAPH POSTS, COILS, &c.

London Agent—ALFRED LAKEMAN, 9, FENCHURCH STREET, E.C.

AND PARLIAMENTARY APPLICATIONS CONDUCTED

ROBT. DEMPSTER & SONS,

GAS ENGINEERS, IRONFOUNDERS, AND CONTRACTORS,

ROSE MOUNT IRON-WORKS, ELLAND, YORKSHIRE,

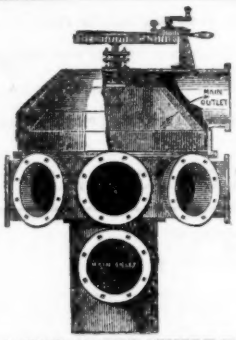
MANUFACTURERS OF EVERY DESCRIPTION OF

GAS APPARATUS;

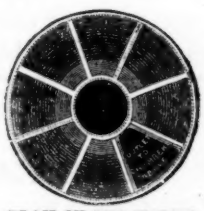
CONTRACTORS FOR THE

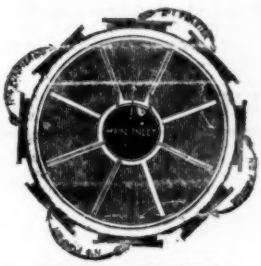
ERECTION OF PUBLIC AND PRIVATE GAS-WORKS.

Plans and Specifications Prepared, and Illustrated Catalogues forwarded on application.



C. & W. WALKERS'
PATENT CENTRE-VALVS.





ELEVATION OF THE CENTRE-VALVE. PLAN OF THE VALVE. PLAN OF THE BODY.

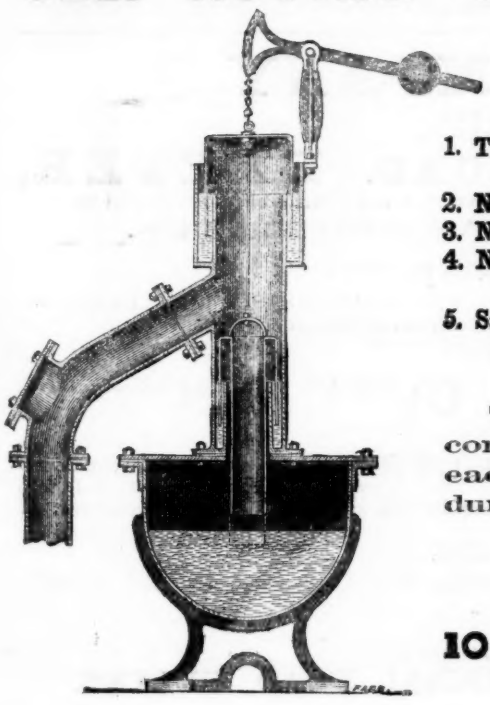
These PATENT CENTRE-VALVES are the most perfect and certain means for working Purifiers on the system of three in action, and one out of action. The Valve itself is protected from all injury inside the safety cover. The working of the Valve is so easy, and so governed by the stop-catch movement, that the Purifiers can be instantaneously changed in the dark as well as in daylight. They are scraped perfectly true, metal to metal, the facings heretofore exposed are always covered, and there is nothing more reliable, certain, and durable in a gas-works. By their use the floor of the Purifying-house is clear and level; the Valve and all connexions being beneath the floor, out of the way of working. A considerable improvement and saving is effected in the cost of the connecting-pipes.

MIDLAND IRON-WORKS, DONNINGTON, near NEWPORT, SHROPSHIRE; 8, FINSBURY CIRCUS, LONDON.

SELF-ACTING REMOVABLE DIP-PIPE,

PATENTED BY

CHANDLER & STEVENSON.



ADVANTAGES.

1. There is no pressure on the Retorts.
2. No deposit of Carbon.
3. No scurfing is required.
4. Never a choked Ascension-Pipe.
5. Saves Fuel and Wear and Tear.
6. Gets 10 per cent. more Gas out of the Coal, and a higher Illuminating Power.
7. Is never out of order.
8. Requires no attention.
9. Is perfectly automatic in its action.

These Dip-Pipes can now be supplied complete, except the flanched bend, for £4 each, which includes the charge for licence during the whole term of the patent.

Applications to be made to

Messrs. CHANDLER & SONS,

104, NEWINGTON CAUSEWAY, S.E.,

Who fix the Dip-Pipes, at a small Charge, when required.

THE

IMPERIAL METER COMPANY,

LIMITED,

KING'S ROAD, LONDON, N.W.,

OFFICE: 115, VICTORIA STREET, WESTMINSTER, S.W.,

MANUFACTURERS OF

"WET" & "DRY" GAS-METERS IN IRON & TIN-PLATE CASES,

STATION-METERS AND GOVERNORS, STREET-LAMP METERS, BOXES, AND REGULATORS FOR THE AVERAGE METER SYSTEM.

Attention is called to their Dry Meters in Wood Cases, as used by the principal London Gas Companies. These Meters are especially suitable for seaport towns and for export.

The Company repair or convert every description of Wet Gas-Meters to De Castro and Burton's Patent.

EDWARD E. CROMBIE & CO.,

INVENTORS AND PATENTEES

OF THE

FRICTIONLESS DRY GAS-METERS,

Beg to intimate to Gas Companies and others that they are now prepared to supply these very superior Meters at the same prices as for the ordinary Gas-Meters.

In the construction of this Meter, for which the best tin plates only are used, every mechanical contrivance has been taken advantage of successfully to reduce the friction to a minimum, which is amply proved by the fact that they are made to work upon only one-fortieth of an inch pressure. By an improvement also in their construction, a steadier light is obtained, and greater capacity than can be got from any other Meter in the market. No gas can pass under the valves on any back pressure, as is the case with many other Dry Meters.

To Gas Companies supplying gas through streets with heavy gradients, these Meters are invaluable, as much gas is saved from the low pressure required to work them.

ALL METERS ARE UPHELD FOR FIVE YEARS.

METROPOLITAN WORKS, DIANA PLACE, EUSTON ROAD, LONDON, N.W.

FLETCHER AND MURPHY,

GARRATT STREET WORKS, OLDHAM ROAD, MANCHESTER;

Manufacturers of

IMPROVED CONSUMERS WET GAS-METERS

IN CAST-IRON CASES,

THE UNVARYING WATER-LINE GAS-METER,

AND

IMPROVED DRY GAS-METERS;

STATION-METERS OF ALL SIZES, with PLANED JOINTS;

GOVERNORS, PRESSURE AND EXHAUST REGISTERS, TEST HOLDERS.

And all kinds of Experimental Gas Apparatus.

WILLEY & COMPANY,

GAS ENGINEERS,

WORKS: COMMERCIAL ROAD, EXETER,

INVITE THE ATTENTION OF GAS COMPANIES AND OTHERS FOR THE SUPPLY OF

EVERY DESCRIPTION OF GAS APPARATUS.

ENGINEERING DEPARTMENT.

NEW GAS-WORKS erected complete. Plans and Estimates furnished. MAINS, METERS, SERVICES, LAMPS, &c., adapted for Towns of any size. Gas Companies advised on Improvements, Extensions, and Alterations of Works.

GASHOLDERS AND TANKS.

RETORTS and RETORT-HOUSE FITTINGS, CONDENSERS, SCRUBBERS, ENGINES and EXHAUSTERS, PURIFIERS, STATION-METERS, GOVERNORS, VALVES, &c.

METER DEPARTMENT.

They beg special attention to the excellence and superiority of their WET and DRY METERS, several thousand being now in use by many of the largest Gas Companies in the West of England and South Wales. Warranted to measure correctly, and not to vary. Their acknowledged superiority has brought them into general use more rapidly than any Meters hitherto manufactured. A guarantee of Five years tendered with each Meter.

GAS-FITTING DEPARTMENT.

An extensive variety of Choice Designs in CHANDELIERS, PENDANTS, BRACKETS, STAR and SUN LIGHTS, MEDIÆVAL FITTINGS for CHURCHES, &c.

PATTERN-BOOKS and PRICE LISTS furnished.

☞ PLEASE NOTE THE ADDRESS—

GAS ENGINEERING WORKS, COMMERCIAL ROAD, EXETER.

GEORGE ORME & CO.,

ATLAS METER-WORKS, OLDHAM,

MANUFACTURERS OF

WET AND DRY GAS-METERS,

STATION-METERS, GOVERNORS,

PRESSURE AND EXHAUST REGISTERS,

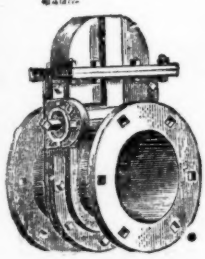
LAMP-METERS IN CAST-IRON BOXES,

And every Description of Gas Apparatus.

B. DONKIN & CO.'S

IMPROVED GAS-VALVES

WITH WROUGHT-IRON PINIONS.



List of prices, with full dimensions of all sizes up to 48-inch, to be had on application.

These Valves are proved on both sides to 30 lbs. on the square inch before leaving the works, and are kept in stock.

ALSO MAKERS OF

J. BEALE'S NEW PATENT GAS EXHAUSTERS,

STEAM ENGINES FOR DRIVING GAS EXHAUSTERS,

VALVES FOR AMMONIACAL LIQUOR,

IMPROVED BRIDGE VALVES FOR REGULATING THE SEAL IN HYDRAULIC MAINS,

BYE-PASS VALVES, &c., &c.

B. DONKIN & CO, 55a, BLUE ANCHOR ROAD, BERMONDSEY, LONDON, S.E.

J. & J. BRADDOCK,

GAS ENGINEERS,

GLOBE METER-WORKS, OLDHAM,

MANUFACTURERS OF

WET & DRY CONSUMERS GAS-METERS,

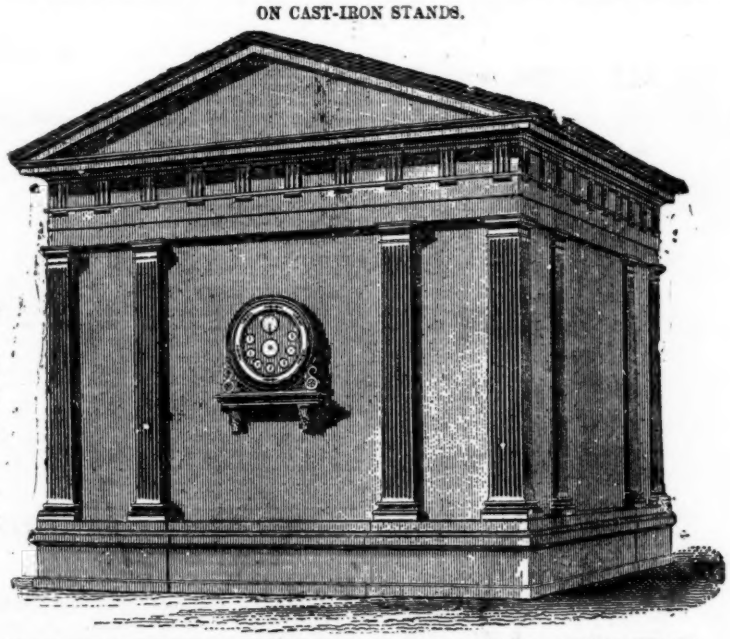
OF THE HIGHEST EXCELLENCE ONLY:

ALSO LICENSEES AND MANUFACTURERS OF

WARNER & COWAN'S PATENT SELF-REGULATING GAS-METERS;

ROUND STATION-METERS,

ON CAST-IRON STANDS.



SQUARE STATION-METERS,

WITH PLANED JOINTS.

GOVERNORS, GAUGES, INDICATORS, MAIN COCKS, &c.

GAS COOKING APPARATUS.

Home and Foreign Orders promptly attended to.

A full Sizes of **CONSUMERS METERS, STATION-METERS, and GOVERNORS** generally in Stock.

Orders almost invariably despatched on the day of receipt.

TERMS, &c., ON APPLICATION.

INTERNATIONAL EXHIBITION, 1862.

CLASS X.

PRIZE MEDAL

For excellence of Fire-Clay Gas Retorts, and "HONOURABLE MENTION" for good quality of Fire-Bricks.

WILLIAM STEPHENSON & SONS,

THROCKLEY,

NEWCASTLE-ON-TYNE.

TO GAS COMPANIES.

GEORGE McKAIG,

MANUFACTURER OF

GAS-PURIFYING WOOD SIEVES,

153, CLEVELAND STREET,

DONCASTER.

It requires but one trial to prove the Superior Make, Strength, and Durability of these Sieves.

CARRIAGE PAID.

DEMPSTER & SONS'

RENOWNED

WOOD SIEVES,

WITH TAPER BARS,

MADE BY MACHINERY

CAPABLE OF MAKING 10,000 PER WEEKLY.

References to Hundreds of First-Class Engineers.

ROSE MOUNT IRON-WORKS,

ELLAND, NEAR HALIFAX.

C. & W. WALKER'S

WOOD PURIFIER SIEVES,

Which have now been used for fifteen years, and their advantages and durability fully established. They are made entirely by steam machinery in very large quantities at the most moderate cost.

MIDLAND IRON-WORKS,

DONNINGTON, NEAR NEWPORT, SHROPSHIRE.

8, FINSBURY CIRCUS, LONDON.

CATOPTRIC LAMPS.

The NEW PATTERN

Is now placed throughout CHEAPSIDE.

For Terms of Licence to Use and Manufacture, apply to

Mr. SKELTON,

37, ESSEX STREET,

STRAND.

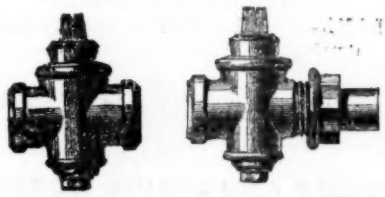
LAMBERT'S

CAST-IRON GAS-MAIN COCKS,

WITH PATENT WHITE METAL PLUGS.

TRADE (L) MARK.

No. 758. No. 759.



The bodies of these Taps are made of iron, black or galvanized, and the plugs of patent metal. They are warranted not to set fast or corrode, as do Iron or Brass Cocks; will always work easily; are strong, well made, durable; of little or no intrinsic value, and therefore not likely to be stolen; and the prices as stated below are (especially upon the larger sizes) fully 50 per cent. less than Brass Cocks.

	½	¾	1	1¼	1½	2-inch.
No. 758, with inside screws for iron pipe, black	2/0	3/0	4/4	6/6	7/6	12/0 each.
No. 759, with union on one end screwed inside for iron pipe, black	2/9	3/10	5/4	8/0	9/0	15/6 each.
Nos. 758 and 759, galvanized	0/3	0/4	0/6	0/8	0/10	1/4 extra.

MANUFACTORY:

SHORT STREET, LAMBETH, LONDON.

ALFRED LASS,
SPECIAL ACCOUNTANT FOR GAS COMPANIES,
30, GRACECHURCH STREET, LONDON.

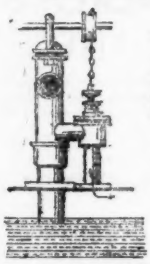
Accounts analyzed and Statistics Prepared for Parliamentary Proceedings, Arbitrations, &c.
The Forms of Account, which have been specially designed by A. L. to meet the requirements of the Gas-Works Clauses Amendment Act, 1871, are now in use by many Gas Companies, and have been universally approved. The above forms are registered.
Water Companies Accounts also prepared and adjusted.
CONSULTATIONS.

JAMES OAKES & CO.,
ALFRETON IRON-WORKS, DERBYSHIRE,
AND
WENLOCK IRON WHARF, 21 & 22, WHARF ROAD, CITY ROAD, LONDON, N.,
Keep in London and at their works large stocks of PIPES and CONNEXIONS (1½ to 36 inches in diameter); also make and supply Retorts, Tanks, Columns, Girders, Special Castings required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.
CHARLES HORSLEY, Agent.

THOMAS CARR & SON,
MANUFACTURERS OF
FIRE-BRICKS, LUMPS, TILES, RETORTS, &c., &c.,
SCOTSWOOD FIRE-BRICK WORKS,
SCOTSWOOD-ON-TYNE.

BOUCK & CO., LIMITED,
TAR DISTILLERS & MANUFACTURING CHEMISTS,
MILES PLATTING, MANCHESTER.
BUYERS OF COAL TAR,
And Crude Products therefrom,
AMMONIACAL LIQUOR, &c.

COPP'S PATENT ANTI-DIP GAS APPARATUS.



Produces from 10 to 20 per cent. more gas of higher illuminating power.
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Retorts last much longer.
Charges work off quicker.
This simple invention has been in use in many works for the last six months, with the above results.
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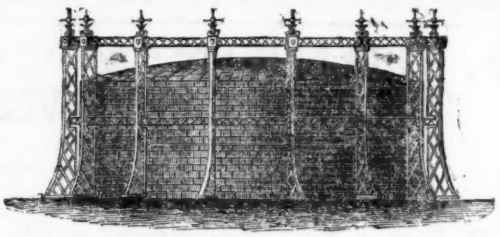
AND ALL MATERIALS FOR GAS MANUFACTURE AND DISTRIBUTION.



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TIPTON, STAFFORDSHIRE.
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Steam-Jet Engineers,
7 and 17, LANCASTER AVENUE,
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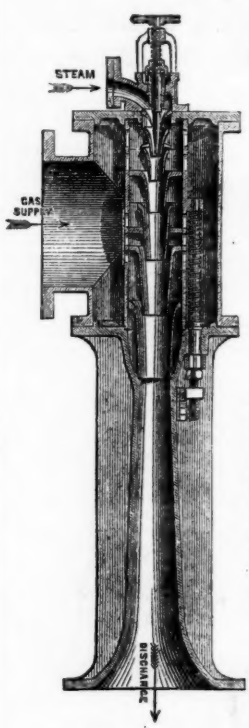
AND 40, LOWER GARDINER STREET, DUBLIN.



E. KÖRTING'S PATENT
STEAM-JET GAS-EXHAUSTER.
IMPROVED CLELAND'S PATENT.
Small Cost—Compactness—Perfectly Self-Acting—Self-Regulating—Self-Cleansing—No Steam-Engine—No Attention—No Extra Room Required—No Wear and Tear—No Noise—No Oscillation in Vacuum, or Back Pressure.
UPWARDS OF 200 IN USE.
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Chartered Gas Co.	Glasgow Corporation.	Hanna, Donald, and Wilson, London.
London Gas Co.	Leyland Gas Co.	Ratcliff Gas-Works.
S. Metropolitan Gas Co.	Stalybridge Gas-Works.	Kendal Gas-Works.
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Liverpool Gas Co.	Birmingham Gas-Works.	Dartford Gas Co.
Bolton Corporation.	Wakefield Gas-Works.	Exeter Gas Co.
Horsham Gas Co.	Brentford Gas-Works.	Harrogate Gas Co.
Epsom and Ewell Gas Co.	Burnley Gas-Works.	Hertford Gas Co.
Ipswich Gas Co.	Guildford Gas-Works.	Waterside Gas-Works, Todmorden.
Cheltenham Gas Co.	Gloucester Gas-Works.	F. W. Grafton and Co., Accrington.
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Cornholme Dis. Gas-Wks.	Nantwich Gas-Works.	
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&c., &c., &c.

E. KÖRTING'S PATENT STEAM-JET REVIVIFYING BLOWERS FOR THE PURIFYING MATERIAL.
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W. CLELAND'S PATENT STEAM SCRUBBER AND SLOW-SPEED CONDENSER.
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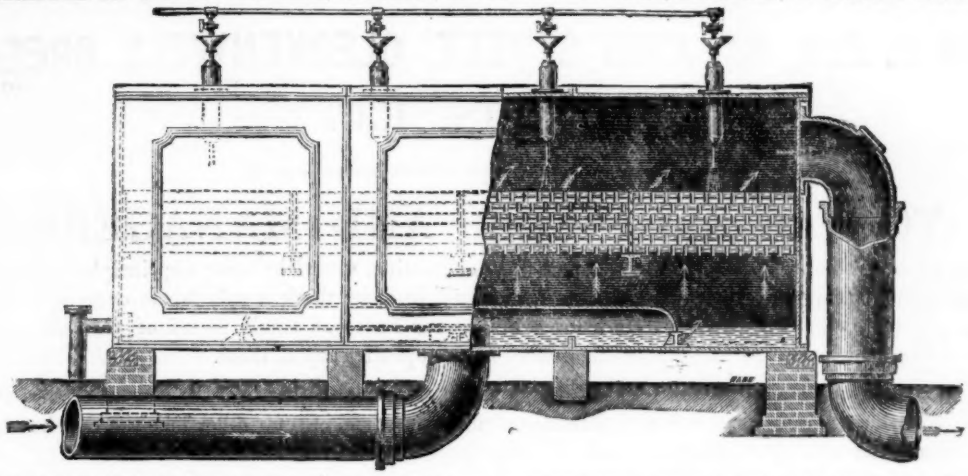
GERALD J. TUPP, 8, John Street, Adelphi, W.C.,
LONDON,
SOLE AGENT FOR ENGLAND AND WALES.

GAS PURIFICATION.

SAVILLE'S SELF-DISTRIBUTING GAS SCRUBBER-WASHER.

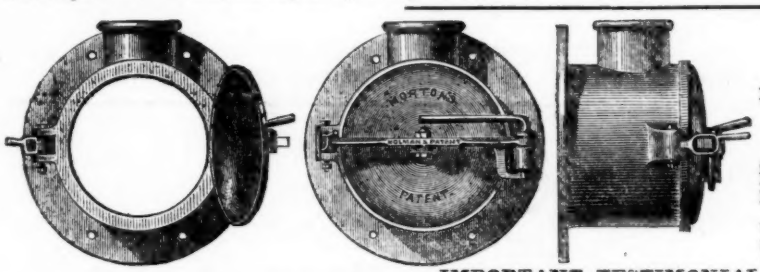
PATENTED IN GREAT BRITAIN, FRANCE, BELGIUM, PRUSSIA, AUSTRIA, & UNITED STATES.



MECHANICAL ARRANGEMENT.—The Washer Tank contains a large bottom chamber, into which the Gas is freely admitted through an ordinary full-way inlet-pipe, passing first under an inverted vessel which removes any Tar remaining in the Gas after leaving the Condenser; it then rises slowly over the whole surface, CONTAINING AN AREA OF ABOUT EIGHT TIMES THAT OF THE INLET-PIPE, through equidistant spaces in a series of Self-Sealing Water Troughs, arranged in tiers, dividing itself and passing through the various dips until it reaches the upper chamber, and from thence through the outlet-main. The washing liquid being CLEAN WATER is admitted by the Syphon inlets on top of Tank to the upper row of troughs, running through each successive tier, and becoming impregnated with the impurities extracted from the Gas, gaining strength at each dip on its descent, and finally passing off by the outlet syphon at the bottom. It will be observed that in this Scrubber-Washer the Gas comes first in contact with THE STRONGEST LIQUOR at the bottom, and passes through WEAKER LIQUOR at each successive tier, until it issues through CLEAN WATER into the upper chamber; hence the true principle of Gas Purification by Washing is simply and automatically effected.

ADVANTAGES.—Great economy in first cost and foundations; great saving of other purifying apparatus and material; occupies little space, and stands only a few feet in height; being entirely self-acting, requires no motive power either for purifying or distributing; the Gas is washed several times in ONE vessel, each time in liquor of a different strength, ultimately passing through CLEAN WATER; produces liquor of any required strength by once passing through; can be fixed (if desired) at any elevation to permit Contractors' tanks being filled without the expense of pumping.

One of these Scrubber-Washers has been in successful operation for the past twelve months at the Sowerby Bridge Gas-Works, and they are now being erected at the Corporation Gas-Works, Adderley Street, Birmingham, and at the Phœnix Gas-Works, Vauxhall, London.



MORTON'S PATENT SELF-SEALING RETORT-LIDS,

WITH

HOLMAN'S NEW PATENT BRACKETED CROSS-BARS, ANTI-FRICTION CATCHES AND ECCENTRIC FASTENINGS.

Instantaneous Sealing effected. No Luting. No Duplicate Lids required. Holman's New Self-Sustaining Cross-Bar ensures freedom of joint and maintains parallel position of the Lids.

Since their introduction in 1869, these Patent Retort-Lids have been thoroughly tested (rigid cast iron is now successfully employed), nearly 25,000 being in use at various Gas-Works in London and the Provinces.

IMPORTANT TESTIMONIAL.

The Gaslight and Coke Company (commonly called the Chartered Gas Company), Beckton, North Woolwich, July 2, 1874.

MESSRS. TANGYE BROTHERS AND HOLMAN.

Gentlemen,—In answer to your inquiry respecting the Self-Sealing Lids, I beg to say that they continue to work well, and I have every reason to be satisfied with them. I should be very sorry to return to the old system of Luting, and our stokers here freely acknowledge the benefit to them of the new system.

I am, yours truly, (Signed) G. C. THEWBY.

HUNT'S PATENT EQUILIBRIUM GAS-GOVERNOR.

In this Governor a Throttle-Valve is substituted for the ordinary suspended Cone, all external communications being avoided by placing the Lever or Radius Arm (shown in the drawing) inside the Valve-Chamber upon the Disc. The Disc is carried upon steel centres, upon which it is accurately balanced and turns freely. The friction in working is thereby reduced to a minimum. This Governor is extremely sensitive to alterations of inlet or outlet pressure, and renders a large actuating holder unnecessary.

The principal advantages of this arrangement over the ordinary form of Governor are as follows:—

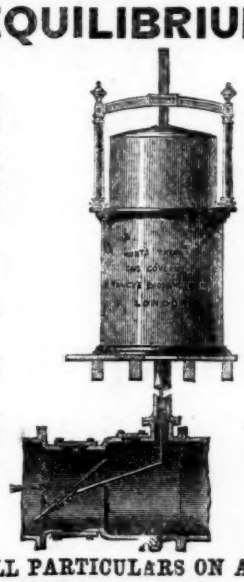
Its sensitive action prevents oscillation.

It is self-adjusting—*i.e.*, it maintains a steady pressure under variations of inlet pressure or a fluctuating consumption.

The inlet to Gasholder being contracted to the smallest possible dimensions, all danger from leakage through insufficiency of seal, tilting, &c., is entirely avoided.

The valve portion being separate from the holder, it can be handled and fixed like an ordinary Slide-Valve direct in the main; and the holder can be placed at any convenient distance immediately above it. The cost is thus materially reduced, and the inconvenience of heavy lifts done away with.

There are no working parts likely to get out of order.



These Governors have been adopted by many leading Gas Companies, among whom are the following:—

The Gaslight and Coke Co. (9), The London Gas Co. (3), and at Abergavenny, Birmingham, Cannes (France), Devonport, Dronfield, Dursley, Exeter, Guernsey, Mentone (France), Monmouth, Newcastle-on-Tyne, Oxford, Plymouth, Rochdale, &c.

TESTIMONIAL.

The Gaslight and Coke Company,
9, Water Street, New Bridge Street,
Blackfriars, E.C., Feb. 27, 1875

MESSRS. TANGYE BROTHERS AND HOLMAN.

Gentlemen,—The two 24-inch and three 36-inch Hunt's Equilibrium Governors supplied by you, and fixed in the valve-rooms at Whitechapel, Goswell Road, and Blackfriars, are working very satisfactorily.

Yours truly,

(Signed) JOHN JOHNSON.

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TANGYE BROTHERS & HOLMAN,

SOLE MANUFACTURERS,

LAURENCE POUNTNEY LANE, LONDON, E.C.

THOMAS GLOVER & CO.,

DRY GAS-METER MANUFACTURERS,

214 TO 222, ST. JOHN STREET, CLERKENWELL GREEN,

LONDON, E.C.

TO GAS ENGINEERS AND MANAGERS.

It having come to our knowledge that a report is in circulation, spread by some unprincipled person or persons, that the cases of our larger-sized Meters are made of Galvanized Iron, we think it only fair to ourselves, and just to our customers, to say, that we never have used, in making any of our Meters, a single pound of *Galvanized Iron*, or any other *cheap* and *inferior material*, and this can be easily seen by opening any of them.

The cases of our large-sized Meters, from 20 lights and upwards, are all made of the very *Best Best Patent Alloy*, which is nearly double the price, and will last more than double the time, of some other material that has been and still is very largely used for the same purpose. And our experience, acquired by an extensive use of it for upwards of 30 years, enables us to say with confidence that no other metal in use for the purpose is so little liable to corrosion from the action of the gas.

We have now in use a Meter made in 1848, and therefore 29 years old, the case of which is made of Patent Alloy; the Meter is still in perfect order, and shows no signs of decay.

The utmost care is exercised by us in selecting none but the very best materials for all parts of our Meters; much of it is made *expressly for us*, as it is not possible to obtain it in the open market of the same superior quality.

The great fall in the price of all materials used in making our Meters has enabled us to give an increased discount, thus giving our customers the benefit of the fall. This we were bound in fairness to do, as we raised the price of our Meters four years ago, when the price of all metals went up.

It will be our constant endeavour, by using none but the best materials, and employing the most skilful workmen, to maintain the high character our Meter has hitherto borne.

WILLIAM PARKINSON & CO.,

(SUCCESSORS TO SAMUEL CROSLEY,)

COTTAGE LANE, CITY ROAD, LONDON, E.C.

Established 1816.

MANUFACTURERS OF PATENT

WET & DRY GAS-METERS,

STATION-METERS WITH PLANED JOINTS,

GOVERNORS, PRESSURE REGISTERS, GAUGES,

AND EXPERIMENTAL APPARATUS,

STREET-LAMP METERS,

AND REGULATORS FOR AVERAGE METER INDICATION.

METERS FOR MEASURING WATER.

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NOTICE TO SUBSCRIBERS.

In consequence of the Easter Holidays, the next Number of the JOURNAL OF GAS LIGHTING *will not be published until Wednesday, April 4.*

TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion, must be authenticated by the name and address of the writer; not necessarily for publication, but as a guarantee of good faith.

A LOVER OF FAIR PLAY.—*We cannot insert anonymous correspondence.*

H. *asks: "Is it the practice of gas engineers, generally, to bye-pass the condenser same as subsequent apparatus?"—If there be more than one condenser, one or both should be bye-passed, or partially so, in case of low temperature, or throwing out for cleaning or repairs. If there be only one, it is a good plan to be able to bye-pass a part in case of low temperature.*

N. T.—*Your mode of washing does not appear to us to be effective, and we fear that unless the water be supplied at such a pressure as to convert it into a spray, it would be almost useless. According to the arrangement shown, the water would dribble away through two or three holes, and no impurity would be removed thereby.*

THE JOURNAL OF GAS LIGHTING,
WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, MARCH 27, 1877.

Circular to Gas Companies.

ABOUT the time we went to press last evening, Mr. Raikes, the Chairman of Ways and Means in the House of Commons, was moving the adoption of a new Standing Order of the House, to follow Standing Order 188, relating to private business. It was, no doubt, adopted, and is to the following effect:—"In every Gas Bill, by which an existing Gas Company is "authorized to raise additional capital, provision shall be made "for the offer of such capital by public auction or tender, at the "best price which can be obtained." Now, much as we love all auctioneers, and glad as we should be to see their opportunies increased, so that they might be induced to attend more to their own business, and indulge in fewer insults to gas officials, we are bound to say that we see no especial advantage to anybody in auction clauses. Thanks to Earl Redesdale, the dividend on the additional capital of Gas Companies is now limited to seven per cent. When such capital is put up to auction, it fetches a price which reduces the interest to the investor to about five per cent.—the amount paid above the nominal value of the shares, or the premium, as it is called, being considered capital not entitled to dividend. We fail to see any special virtue in this non-dividend bearing capital; but, on the contrary, regard it as offering many temptations. We think, therefore, it would be far better if the Legislature would abolish the hammer-work, with its inevitable commission—and what auctioneer would not rejoice over the smallest reduction in the expenses of a Gas Company?—and at once say that the maximum dividend on additional capital shall be five per cent. In this way, existing shareholders would get what the Legislature has in past times assigned to them, and the public would be spared the payment of two per cent., while a good deal of unnecessary trouble, and some little expense, would be saved to the Gas Companies concerned. We write this with the conviction that, before these lines meet the reader's eye, the Standing Order will have been adopted; but, nevertheless, we think it right to put a protest upon paper.

For the advantage of our Irish friends, we may call their attention to the Public Health (Ireland) Bill, which proposes to do for Irish Local Authorities and Gas Companies exactly what the English Public Health Act, 1875, has done for us in this country. We may say that up to this time the English Act has done no harm to gas interests, but it is capable of being made an instrument of wrong-doing, and, therefore, we give to our Irish brethren the advice we have repeatedly tendered to English Companies, and say that no Company of any standing, or with prospects, should neglect to clothe themselves, as early as possible, with statutory powers, either by Provisional Order or by special Act. These, so long as the Company do their duty to the public fairly, constitute a coat of mail, proof against the attacks of a Local Authority; without them the Company are at the mercy of any Board in their district.

How important it is that a Gas Company should have statutory powers, is shown by a report we shall publish in our next number. It is no fault of the Colne Valley Gas Company that they have not statutory rights. They tried to obtain them last session, but were unsuccessful, being opposed by the Longwood Gas Company, already in possession of the greater part of the limits they proposed, and being incorporated with statutory powers. The Colne Valley Company seem to have had their origin in the opposition of some millowners along the valley to the Longwood Company, whose gas they considered too dear, and hence desired to set up a competing supply. Now, according to the present state of the law, no competition between a statutory and a non-statutory company is possible. The Legislature might confer competing powers under peculiar circumstances, but, without such authority, competition is out of the question. It cannot be too widely known among non-statutory Gas Companies, that no authority save Parliament can enable them, with impunity, to break up a public road. Any one—he need not, we believe, be a resident in the district—can indict a Company, who break up a highway, for committing a nuisance. Under such circumstances, it is, as we have said, the duty of Gas Companies to clearly define their limits, and obtain legislative sanction for their undertaking. When the limits proposed overlap those of another Company, Parliament must decide between the contending parties.

It may well be supposed that the Chartered Company, in accordance with the suggestion of the Board of Trade, will introduce into the Bill they are promoting a clause or clauses to remove the difficulty that arises from the impossibility of specifying the particular manufacturing station from which gas of defective illuminating power is delivered. The great sulphur battle will not be fought for some weeks, and the issue is somewhat doubtful. In the meantime, the Board of Trade have intimated to the Metropolitan Board of Works their intention, if the Bill of the Chartered Company should fail to obtain the sanction of Parliament, to consider the propriety of introducing a short Bill to remove the difficulty above referred to. This is very kind. It appears that some correspondence has taken place between the Board of Trade and the Gas Referees, about the purification of gas from sulphur. We have not yet received a copy of this correspondence, but shall endeavour to obtain one, and allow our readers to form their own judgment of its value.

The Metropolis Gas Act, 1860, was one of the most equitable measures ever passed by Parliament. It did justice to the Gas Companies, while it offered to consumers and Local Authorities,

full powers for compelling compliance with its provisions. It is hardly necessary to say, that the Vestries and District Boards, for the most part, took no interest in the matter. A few did set up testing-places, and appointed utterly incompetent examiners. The only serious attempt to enforce the provisions of the Act was made by the Corporation of the City of London; but the single prosecution instituted by that body broke down on a purely technical point. Nothing like that failure could have occurred in the case of any Vestry or District Board in the Metropolis; but no one of them ever took any steps to enforce the Act. Now, in this year of grace, 1877, the Vestry of Rotherhithe, who have had for sixteen years full powers, under the Act we have mentioned, to test the gas of the Surrey Consumers Company, apply to the Metropolitan Board of Works, who have no power of the sort, to cause the gas supplied to the parish to be tested for them. They were very properly snubbed, and told that the law gave them all the powers necessary, if they would only put them in force. That a London Vestry should not know the protection conferred by the Act of 1860 is extraordinary, and seems to show that they must have a treasure of a clerk. How he earns his salary—which, in the case of most vestry-clerks, is really "princely"—we cannot imagine. We wonder whether he spends his princely emolument (hours of duty, say, from ten a.m. to four p.m.) on pictures.

The gas disputes at Wigan have attracted much attention all over the kingdom, for there is hardly a town in which similar disputes have not, at some time or other, arisen. We print, in another place, the report of Mr. Newbigging to the Committee of the Gas Consumers Association. Our readers will remember that the Committee nominated the gentleman, whose report we print, together with Mr. Littlewood, of the Manchester Gas-Works, to make the inquiry; but it seems that the Gas Committee of the Corporation of Manchester refused Mr. Littlewood permission to join in the investigation, alleging that it is contrary to their practice to allow their servants to undertake duties outside their own gas-works. This seems curious, since everybody knows that whenever a Gas Company are attacked in Parliament by municipal body, Sir Joseph Heron invariably turns up as a witness. In the instance under notice, the one Corporation might with propriety have assisted the other, the more so as the Corporation of Manchester are not altogether free from the complaints brought against the sister Corporation of Wigan.

Mr. Newbigging's report is of much interest, but it travels over more ground than we have space to follow. There can be no doubt that he satisfactorily explains the cause of the apparently anomalous increase in the amount of the consumers gas bills. It would seem clear that the gas supply of Wigan can never be in a satisfactory state until the whole undertaking is remodelled. All our readers will sympathize with the unfortunate manager, condemned to keep up a sufficient supply under the circumstances described. In the account of the mains, certain revelations are made which demand a most strict inquiry. The circumstances are, as far as our recollection serves us, altogether unprecedented. We never before heard, or read, of an instance in which the mains of a Corporation or Gas Company were tampered with as described by Mr. Newbigging. It is, however, very satisfactory to learn that, with all their difficulties—and their plunder, some will say—the Corporation of Wigan made last year a profit of £11,000 by the supply of gas, and it is supposed that a reduction of price will soon be announced.

The Sheffield Gas Company are about to reduce the price of gas, and comic writers are anticipating that the gas bills will, in consequence, be higher than ever. People say the same at Wigan, so Companies and Corporations equally find it difficult to satisfy their customers. The fact is that a gas consumer is like a man under castigation with the cat-o'-nine-tails. There is no pleasing him.

The Corporation of Worcester have cast longing eyes on the Gas Company, but, up to recently, have taken no steps towards confiscation. Now, however, they have instructed their Town-Clerk to write to all other Town-Clerks, and ask whether or not their Corporations possess a gas undertaking, and, if they do, whether or not it is profitable, and to what extent. We hope that all Town-Clerks will receive the communication with equanimity, and freely supply all the information requested. The returns, when made up, will form a very interesting document, which we shall hope to be able to lay before our readers. We do not suppose that it will frighten the Corporation from their purpose. It cannot be denied that the great majority of the gas undertakings in the hands of Municipalities are sources of profit. To the questions about to be asked, we think that another might have been added, the answer to which might have been useful to one, at all events, in the Corporation of Worcester. It should have been asked what the Municipalities, who have bought up Gas Companies, have paid for the undertakings. It will be seen in the report that the Alderman who leads the attack proposes to acquire the Worcester Gas Company, by giving to the shareholders bonds to the amount of £25,000, bearing interest at the rate of ten per cent. The sum named, we suppose, represents the expended capital of the Company; but, according to the worthy Alderman's own showing, the Company have, beyond their capital, spent on the works £50,000 or £60,000 out of profits. Does he expect to get the value of this expenditure for nothing? If he do, he will soon be undeceived, when the matter comes before a Parliamentary Committee.

The Warrington Gas Purchase Bill has practically been passed, of course, without opposition, and thus another Gas Company disappears.

By the passing, unopposed, of the Blackburn Borough Gas, Water, and Extension Bill, with a slight modification, the Blackburn Gas Company are also extinguished. The Company, at the last moment, withdrew their opposition, and consented to sell by agreement, the terms being already arranged. What these are we do not, at present, know; but shall, of course, learn in due time.

The case of the Ramsgate Local Board Bill, before a Committee of the House of Commons, dragged its slow length along for more than a week, when the Board put forward a witness—a gas-fitter—who swore that the gas supplied by the Isle of Thanet Gas Company to Margate was so impure that he had seen it escape from a leak in a gas-pipe in the shape of a yellow vapour. This was enough for the Committee, and although the counsel of the Board stated that he had several more witnesses to call, the case for the promoters was promptly closed. That for the Gas and Water Companies was opened without any speechifying, and after the examination of several witnesses, the Committee, on Friday last, on adjourning, expressed a hope, as they had done a week previously, that before they met again on Monday, some agreement would be come to by the contending parties. On reassembling yesterday, however, they found that no agreement had been arrived at, and we do not see how it could. It was impossible that the Companies could give way, and in the end (to cut the story short for this week) the Committee declared the preamble of the Ramsgate Local Board "not "proved," and they passed the preambles of the Bills of the Isle of Thanet Gas and Ramsgate Water Companies. There remains to be a fight over the clauses in both Bills, which will take place when the Committee meet again after Easter. The main obstacle to a prompt settlement of the dispute appears to be some question as to the amount of "Improvement Stock" to be allowed; and on this point we shall offer no opinion as the matter now stands, being certain that the Companies will propose only what is just.

The accounts of the Alliance and Dublin Company for the past half year, with the report of the Directors, have been published. It is gratifying to see that the Directors are able to propose a ten per cent. dividend, after the payment of which, free of income-tax, there will be the respectable balance of £5201 to carry forward. We shall refer to the accounts again, and shall now only congratulate the shareholders on the success achieved.

At Preston, the Borough Accountant publishes a yearly analysis of the accounts of the Gas Company. That for 1876 has just been issued. It is hardly necessary to say that it shows the Company to be in a very prosperous condition. Full dividends have been paid, while the reserve-fund has been added to, so that it now stands at almost the maximum amount. There is no doubt that this excellently-managed Company give perfect satisfaction in the borough, and we hear nothing at Preston about making a compulsory purchase. We shall give the analysis next week.

A deputation from the Liverpool Land and House Owners Association have had an interview with the Home Secretary, to protest against the repeal of the Borough Funds Act, the advisability of which the Association of Municipal Officers urged upon Mr. Cross the other day. Although we have regretted the operation of the Borough Funds Act in Liverpool, we entirely agree with the deputation, in claiming for the ratepayers a direct control over extraordinary expenditure. The circumstances at Liverpool are, it seems, a little peculiar. The greater number of members of the Corporation are not residents in the borough, and are, consequently, but small ratepayers, and the deputation, who professed to represent the large ratepayers, objected to the Town Council having an uncontrolled command over the real ratepayers purses. The Home Secretary was, of course, reticent; but we do not think Gas Companies need fear the repeal of the Borough Funds Act this session.

A formal commencement of the proceedings in connexion with the purchase of portions of the gas undertaking of the Corporation of Birmingham, by several outlying Local Authorities,

was made on the 18th inst. The arbitrator appointed by the Corporation is Mr. T. Hawksley, and the Local Boards have selected Mr. F. J. Bramwell. These gentlemen have chosen Sir H. A. Hunt as umpire. The inquiry will necessarily be protracted, and as it would be extremely inconvenient for the arbitrators and umpire to be absent from London, until the Private Bills before Parliament have been disposed of, the proceedings at Birmingham have been adjourned until the end of July, the precise day not having been fixed.

The accounts of the South Metropolitan Company, for the past half year, have been issued. They show a balance applicable to dividend of £26,230 19s., and as the payment of full dividends will only absorb £21,500, there is a substantial balance to carry forward. In the current half year, the advanced price of gas and the meter-rents will, no doubt, result in a still more favourable balance-sheet.

The accounts of the London Gas Company for the half year show a balance applicable to dividend, on ordinary capital, of £30,517. The amount required for payment of full dividends is £19,185; there is, therefore, a sum of £11,332 to be carried forward to the current half year.

The Crystal Palace District Company are scarcely less fortunate. The Directors propose to pay full dividends, and when they have done so, there will remain a balance of £390.

Correspondence.

ESTIMATION OF SULPHUR IN COAL GAS.

Sir,—My attention has just been directed by Mr. Heisch to a paper by Messrs. Silliman and Sadler "On the Volumetric Estimation of Sulphur in Coal Gas," published in the current issue of your valuable Journal. The enclosed paper* upon the same subject was at that moment lying on my table, waiting transmission to you. You will notice that, although the principle is precisely the same as that involved in the former paper, the apparatus used is different, the form I recommend is more simple, and, moreover, is at hand in most large English laboratories where gas-testing is carried on.

I am very glad to find that Messrs. Silliman and Sadler confirm my results so perfectly, and trust, under the circumstances, you will kindly find space for my paper in an early issue.

I may add that the successive stages in my experiments were perfectly well known to Mr. Heisch, and that the fact of my applying standard alkaline solutions to this purpose is known to Mr. Trewby, of the Beckton works (indeed, Mr. Bush, of the same works, tried experiments with my standard solutions nearly two years back), to several of the metropolitan gas examiners, and many others.

W. C. Young, F.C.S., &c.,
City of London and Metropolitan Gas Examiner.

Gas Examiner's Laboratory, Beckton Road, North Woolwich, E.,
March 21, 1877.

Parliamentary Intelligence.

HOUSE OF LORDS.

Monday, March 19, 1877.

Petitions were presented in favour of the Blackburn Borough Gas, Water, and Extension Bill from (1) Inhabitants of Blackburn, (2) Spinners, weavers, and operatives of Blackburn; and in favour of the East Worcestershire Water Bill from Local Board of Redditch.

Tuesday, March 20.

The Examiners reported that the further Standing Orders applicable to the Sittingbourne Gas Bill had been complied with.

The Select Committee on the Blackburn Borough Gas, Water, and Extension Bill, reported that they had not proceeded with the consideration of the Bill, having found that the petitioner had no *locus standi* before them.

The Lowestoft Water, Gas, and Market Bill was reported, with amendments.

The Duke of Richmond and Gordon gave notice that on Friday, March 23, he would move for a select committee, to inquire into the operation of existing statutes in regard to the formation of, and proceedings by, Commissioners of Sewers, Drainage, and River Navigation Boards; to consider by what means such bodies may be more conveniently and inexpensively constituted, their procedure improved, and their powers enlarged, so as to provide more efficiently for storeage of water, the prevention of floods, and the discharge of other functions appertaining to conservancy boards.

Thursday, March 22.

A petition in favour of the East Worcestershire Water Bill was presented from the Local Board and Town Commissioners of Bromsgrove.

Friday, March 23.

The Sittingbourne Gas Bill was read a second time and committed.

The Lowestoft Water, Gas, and Market Bill was read the third time, passed, and sent to the Commons.

The Dublin Improvement Acts Amendment Bill was read the first time.

A petition against the Sittingbourne Gas Bill was presented from the Milton-next-Sittingbourne Town Improvement Commissioners.

PREVENTION OF FLOODS AND STOREAGE OF WATER.

The Duke of Richmond, in moving for a select committee to inquire into the operation of the existing statutes in regard to the formation of and proceedings by Commissioners of Sewers, Drainage, and Navigation Boards, and to consider by what means such bodies might be more conveniently and inexpensively constituted, their precedure improved, and their powers enlarged, so as to provide more efficiently for storeage of water, the prevention of floods, and the discharge of other functions appertaining to conservancy boards, said that, considering the state to which the country was brought during the last autumn and winter, from the prevalence of floods, he thought it would not be deemed surprising that the Government had taken up the matter to which his motion referred. The powers vested in the commissioners, though useful for ordinary occasions, were evidently not sufficient at periods of great floods. Another object which made the appointment of a committee desirable was that an inquiry might be instituted respecting the storeage of water in different parts of the country.

The Marquis of Ripon entirely approved the motion, and suggested that the inquiry should be completed as soon as possible. He also thought that each separate river should be maintained under local management.

Earl Fortescue trusted that no time might be lost in legislating on the subject.

The motion was agreed to.

HOUSE OF COMMONS.

Monday, March 19, 1877.

The Gaslight and Coke Company Bill was read a second time, and committed.

The Examiners reported that the further Standing Order applicable to the Colne Valley Gas Bill has been complied with.

A petition in favour of the Ramsgate Local Board Bill was presented from Ratepayers of High Street, Ramsgate.

The following petitions against the Leeds Improvement Bill were withdrawn:—(1) Great Northern Railway Company, (2) Aire and Calder Navigation Company, (3) Fire insurance companies, (4) Owners of houses, &c., in Leeds, (5) Leeds and Liverpool Canal Company.

METROPOLITAN VESTRY CONTRACTS.

Mr. Beckett Denison gave notice that early after Easter he would move for a select committee to inquire into the system of metropolitan vestry contracts, in so far as they affect the paving, lighting, cleansing, and watering of the streets of the Metropolis outside the City of London, and the removal of refuse from dwellings.

Tuesday, March 20.

The North Cheshire Water Bill was read a second time, and committed.

On the motion of Sir Charles Forster, it was ordered that the minutes of the evidence taken before the Referees on the Leeds Corporation Water Bill, in session 1867, be referred to the committee on the Leeds Improvement Bill.

A petition in favour of the Hanley Corporation Gas Bill was presented from Inhabitants and ratepayers of Hanley, in public meeting assembled.

The petitions were withdrawn of (1) Earl Cowper, (2) Middleton Estate and Colliery Company, Limited, and others, against the Leeds Improvement Bill; and of (1) Corporation of Newcastle-upon-Tyne, (2) Corporation of Gateshead, against the Newcastle and Gateshead Water Bill.

The Glasgow Corporation Water and Perth Water Bills were referred to a Select Committee, consisting of Lord Eslington (chairman), Sir Nathaniel de Rothschild, Mr. Fay, and Mr. Fremantle; to meet on Tuesday, April 10.

The Bolton Improvement, Bishop Auckland District Gas, and Newcastle and Gateshead Water Bills were referred to a Select Committee consisting of Sir John St. Aubyn (chairman), Mr. Bromley Davenport, Mr. Finch, and Mr. Browne; to meet on Wednesday, April 11.

Mr. Cawley's motion in regard to Private Bill Legislation was further deferred from Tuesday, March 27, to April 17.

STOREAGE OF WATER FOR THE USE OF VILLAGES.

Mr. Ryder asked the Secretary of State for the Home Department whether the kindred question of the storeage of water for the use of villages will be referred to the Select Committee of the House of Lords which is to be appointed to consider the subject of the Prevention of Floods.

Mr. Cross said that the Lord President of the Council would give notice in the House of Lords very shortly—probably that evening—of his intention to move for a Select Committee to consider the subject of the prevention of floods. The same committee would also consider the kindred question of the storeage of water for the use of villages.

Wednesday, March 21.

The Heywood Water Bill was read a second time and committed.

A petition in favour of the Leeds Improvement Bill was presented from the Leeds Chamber of Commerce.

A petition against the Crystal Palace District Gas Bill (the petitioners not praying to be heard) was presented from the Bromley Union Rural Sanitary Authority.

AUCTION CLAUSES IN GAS BILLS.

Mr. Raikes gave notice that, on Monday, March 26, he would move the following new Standing Order:—

"*Gas Companies—Additional Capital.*—In every Bill by which an existing gas company is authorized to raise additional capital, provision shall be made for the offer of such capital by public auction or tender, at the best price which can be obtained."

Thursday, March 22.

The Examiners reported that the further Standing Order applicable to the Newport (Monmouthshire) Gas, and Waterford Gas Bills has been complied with.

A petition in favour of the Perth Water Bill was presented from the Glover Incorporation of Perth.

The Select Committee on the Glasgow Corporation Water and Perth Water Bills was altered by the appointment of Mr. Heygate (chairman) and Mr. W. E. Price, in place of Lord Eslington and Mr. Fay.

Friday, March 23.

The following Bills were reported:—Maryport District and Harbour Gas; Middlesbrough Corporation; Rotherham Corporation; Warrington Corporation Gas.

The Edinburgh and District Water Bill, as amended, was considered, and amendments made.

The Falmouth Water and London Corporation Bills, as amended, were considered.

The Longton Corporation Bill, as amended, was considered, and an amendment made.

The Examiners reported that the further Standing Order applicable to the Woolwich, Plumstead, and Charlton Consumers Gas Bill has been complied with.

Mr. Whalley gave notice that on Monday, March 26, he would move for leave to bring in a Bill to give further facilities to landowners of limited estates in England and Wales to charge such estates with the expense of constructing reservoirs for the storeage of water.

* Mr. Young's paper is given on page 464.

Legal Intelligence.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

SATURDAY, MARCH 24.

(*Before Vice-Chancellor* MALINS.)

In re THE EUPION GAS COMPANY.

The further hearing of the motion in this matter was resumed this morning.

Mr. HIGGINS, Q.C. (with him Mr. DIBDEN), stated that, after full consideration, he had come to the conclusion that the decision given by his lordship on March 17, in Henry Kelsall Aspinall's case, applied equally to all the cases of original allottees. The following persons would, therefore, be placed upon the register for the number of shares held by them:—Mr. John Eames Aspinall, 500 shares; William Christian Aspinall, 250; Henry Edward Aspinall, 600; Guy White, 600; John Holmes, 25; William White, 1000; and G. P. Knocker, 1200. The next case was that of John Richardson, whom it was sought to put on the list for 20,900 shares. As the facts were different to those in the former case, he would call his lordship's attention to them. Since the proceedings had been instituted Richardson had died, and he was, therefore, represented by his legal personal representative.

Mr. GLASSE said that the official liquidator was quite willing Richardson's name should be taken off the list in respect of 15,000 out of the 20,900 shares, they being vendor's shares.

Mr. HIGGINS said that, as those shares had been transferred to him without notice, it was clear that the call order could not be supported.

The VICE-CHANCELLOR: I understand that the official liquidator gives them up.

Mr. GLASSE said that was so. He was quite content to keep Richardson on the list for 5900 shares.

Mr. HIGGINS said he might mention that the decision in this case would also govern the cases of Ernest Dawson and Alexander Cloy. These three were transferees of fully paid-up shares, the transfers being deposited with the company, who accepted them as transfers of fully paid-up shares. Richardson before his death made an affidavit, in which he stated that until the 7th or 8th of September, 1874, he never heard of the company, and knew nothing of its creation, that at the request of Joseph Aspinall he allowed his name to be used as a transferee of fully paid-up shares, and that he acted solely as Joseph Aspinall's agent. The case was clearly within the authority of Carling's case, *In re The Western of Canada Oil-Works Company*, and therefore Richardson's name must be taken off the list.

Mr. GLASSE, Q.C. (with him Mr. MONTAGUE COOKSON, Q.C.), for the official liquidator, said that, on the date of the transfer in question, there were 50,000 shares in the company, and at the request of Joseph Aspinall, Richardson and his two clerks, Dawson and Cloy, voluntarily took a transfer of 25,870 shares, and on the same day they executed a blank transfer of the shares, which they put into the hands of Joseph Aspinall, and not one single shilling was paid upon the shares. Richardson, in his affidavit, gave the following account of the transaction:—"At the request, and as the agent of Joseph Aspinall, I permitted my name to be used as transferee for fully paid-up shares in the company, amounting altogether to 20,900, and I acted solely as Joseph Aspinall's agent. The shares were represented to be, and they were described, as fully paid-up shares. I paid no money in respect of them, nor have I ever received any money or interest in any shape or form for the use of my name, either from Joseph Aspinall or from any one else whomsoever, and had the shares not been represented to me as fully paid-up, I should not have taken them, or permitted my name to be used by Aspinall. Immediately after signing the transfer of the shares to me, I, at the request of Aspinall, executed a transfer of every one of the shares from myself, in the usual form of transfer, with a blank left for the name of the transferee, to be filled in by Aspinall." That was Richardson's own statement, and he put it to his lordship whether that was not part of the original fraud.

The VICE-CHANCELLOR said it appeared to him to be so.

Mr. HIGGINS said the evidence did not bring home to either Richardson, Dawson, or Cloy any knowledge of the company's fraud.

Mr. GLASSE said he did not wish to impute fraud to the three persons. If any one chose to throw himself into the arms of Joseph Aspinall, as Richardson did, he must take the consequences of so doing.

The VICE-CHANCELLOR said that if merchants would lend themselves to such transactions, by which a fraud was committed upon the public, they must take the consequeuces. If Mr. Higgius thought he could make anything of the case, he would hear it upon another occasion. As it was past the time for the rising of the Court, the case would stand part heard for Mr. Higgins to reply.

Mr. HIGGINS thought it would be useless, after his lordship had expressed such an opinion, to occupy the time of the Court further.

The VICE-CHANCELLOR said that Richardson had, upon his own showing, aided, abetted, and assisted Joseph Aspinall in the perpetration of the fraud for which he had been convicted; therefore his name would remain upon the list for the 5900 shares. Dawson and Cloy would also be put upon the list in respect of the shares held by them. If persons did not lend themselves to such transactions as the present, the frauds upon the public would not take place.

Mr. HIGGINS said the next case was that of Joseph Aspinall, who was settled on the list for 2200 shares. As to 2000 of them he was a transferee, and, therefore, after his lordship's judgment, it would be useless to contend he was not liable. But as to the 200 shares, his case was that he paid for them by a cheque on his own private bankers, and that he never got the money from the company at all. Therefore he should submit that Joseph Aspinall ought not to be put on the list for the 200 shares.

Mr. GLASSE said it was perfectly plain, from the books, that Joseph Aspinall got the money from the Midland Bank in the first instance, that he then paid it into his own bankers, then to the company, and afterwards back to the bank.

The VICE-CHANCELLOR considered that he must be put on the list in respect of the whole number.

Mr. HIGGINS asked that Richardson's costs might be paid by the company, he having succeeded upon the greater part of his case, being relieved of liability in respect of 15,000 out of 20,900 shares.

The VICE-CHANCELLOR said he could not give any costs. The costs of the official liquidator would be borne jointly and severally by the parties who had lost.

ILFRACOMBE SPECIAL SESSIONS.—TUESDAY, MARCH 20.

(*Before Mr.* N. VYE, *Chairman; Rev.* H. W. TOMS, *and Mr.* G. N. MAULE.)

ALLEGED NUISANCE AT THE ILFRACOMBE GAS-WORKS.

In this case, three summonses had been taken out by the Local Board, as the Urban Sanitary Authority, against the Gas Company, for nuisance; the first being for unlawfully carrying on the business of manufacturers of sulphate of ammonia, which was noxious and offensive, and which was established after the passing of the Public Health Act, 1875, without first obtaining the consent, in writing, of the local board, the board being the Urban Sanitary Authority for the district. The second summons was for unlawfully carrying on the business of manufacturers of sulphate of ammonia, so as to cause effluvium, which was a nuisance, or injurious to the health of the inhabitants. The third summons was for unlawfully carrying on the business of gas manufacturers, so as to cause effluvium, which was a nuisance, or injurious to the health of the inhabitants of the district.

Mr. THORNE, who appeared with Mr. BARRETT to prosecute for the local board, said he proposed to take the third summons first. This summons was taken out under the 114th section of the Public Health Act, 1875, which provided that if any manufactory, building, or place used for any trade, business, process, or manufacture, causing effluvia, was certified to the Urban Authority by the Medical Officer of Health, or by any two legally qualified medical practitioners, or by any ten inhabitants of the district, to be a nuisance, or injurious to the health of any of the inhabitants of the district, the Urban Authority were bound to direct complaint to be made before a justice, who might summon the person by or on whose behalf the trade so complained of was carried on, to appear before a court of summary jurisdiction. In the present case, there was no ill-feeling against the company by the local board, but these proceedings had been instituted in consequence of a certificate having been presented to them, signed by ten or more inhabitants of the district, in conformity with the Act, and calling upon them to take the matter before the justices. He did not wish it to be inferred, however, that the local board differed from the opinions stated by the inhabitants; he simply stated the fact to prevent an inference being drawn one way or the other. The certificate of the inhabitants complaining of a nuisance arising from the gas-works was then read, and Mr. Thorne proceeded to explain the nature of the alleged nuisance, stating that the escape of sulphuretted hydrogen was the principal cause of the nuisance. That was a gas which was of a highly injurious character, as was shown by Dr. Blyth's "Dictionary of Hygiene and Public Health," which stated that it was an active poison, and when breathed undiluted was immediately fatal; it was absorbed by the blood, and thus circulated in all the tissues of the body, and it was a nuisance most decidedly injurious to health. Another matter which caused a bad smell was the manufacture of sulphate of ammonia, and Dr. Letheby had laid down, in a lecture, delivered in January, 1875, how the evils arising from sulphate of ammonia might be avoided. Mr. Thorne concluded by stating that the local board had no desire to have a fine inflicted on the gas company, but only that the nuisance should be abated. There was no doubt that lately they had been setting their house in order, and he thought litigation might have been prevented had the gas company frankly asked the board to visit the works, and see what they were doing.

Formal proof was given by the clerk to the local board (Mr. *W. E. Langdon*) of the receipt of the certificate of complaint.

Mr. *Joseph Brand*, grocer, of High Street, stated that he signed the certificate. The smells in question had been a nuisance to him and his family for a long time past, especially on the 18th of January and 6th of February. Latterly it had not been so bad, but some time back it used to occur about once a week. The smell was very nauseous, worse than the smell from a drain; the effect it had upon him was to make him sick. In his opinion the smell proceeded from the gas-works. He had seen droppings of stuff like lime in the streets, and had traced them to the gas-works. The stuff presented the appearance of lime reduced to a kind of mortar, with a mixture something like brimstone in colour, and he had seen this stuff carted away from the works in open carts. His wife had suffered in a similar way to himself. The smells generally lasted two or three hours. He had on many occasions been obliged to leave his house. The gas pendants in his house frequently got discoloured, but he did not know enough of the subject to say whether the discolouration was caused by the sulphuretted hydrogen.

Mrs. *Barrett*, wife of a schoolmaster, living at No. 1, Brookfield Place, who also signed the certificate, deposed to the bad smells from what she believed to be the gas-works. The smells occurred three or four times a week. She was obliged to shut all the windows and doors in order to exclude the smells. It generally had the effect of making her sick.

Lieutenant *Williams*, residing at Watermouth Castle, stated that he was the principal complainant in the case. He had obtained the signatures to the certificate, because he was informed that it was necessary to do so. He had some property near the gas-works, and, on Jan. 18, in consequence of a communication from the wife of his tenant (Sir Thomas Hepburn), he immediately came into the town, and in the district of the gas-works he noticed an abominable and intolerable stench, just as if a dozen cesspits were being simultaneously emptied. He then went to the first ten inhabitants, and got the certificate signed. He had been obliged to have another window made on the opposite side of his house, so as to counteract in a slight measure the smells.

Mr. *Richard Lock* said he very often noticed a disagreeable smell issuing from the gas-works. In cross-examination, he stated that it did not injure him or his family, for he did not take much notice of the smell of gas.

Mrs. *Hookway*, wife of a baker, deposed to noticing bad smells which made her sick, but when the wind blew from her house towards the gas-works, the smell was not so bad.

Mr. *Barrett*, schoolmaster, spoke as to the bad smells, which he likened to that arising from a rotten egg.

Mr. *Coats*, of High Street, stated that he had suffered from sickness and headache very much from the smell, which was very bad on Jan. 18, 26, 29, 30, Feb. 6, 7, 17, 19, and March 2, 13, and 14. He had no doubt that it arose from the gas-works. His wife often vomited when the smell came into their house. On Jan. 29 it was very bad, lasting nearly all day. It was generally worse about eight o'clock in the morning.

Mr. and Mrs. *Blackford* and Mrs. *Balsdon* gave similar testimony, the latter stating that the smells sometimes were sufficient to suffocate her. She was able to taste the gas with her food. It had affected the appetites of her children. It had made her always feel very unwell.

At this stage of the proceedings the Court was adjourned, and the magistrates paid a visit to the gas-works. On resuming,

Dr. *Slade-King*, the Medical Officer of Health to the Local Board, was examined. He stated that he had some familiarity with the process of making gas. His attention had been called to the prevalence of bad smells existing at the gas-works, and in consequence he had gone there, and had sometimes found strong effluvia, and sometimes not. He had also seen the product of sulphate of ammonia. The smell would affect people in different ways. The symptoms of which the previous witnesses had complained were what might reasonably be expected. Sulphuretted hydrogen would be found in the manufacture of sulphate of ammonia; the purifiers also gave off a stinking compound of ammonia and sulphur. The purifying substance the gas company used was ordinary white lime, which he had seen there; he had also seen the spent material in transit from the works. When brought in contact with earth the smell of the lime would not be so great. He had seen the lime covered with ashes, but the dry earth system was the best. The witness suggested certain improvements with respect to the purifiers, the carting of the lime, and the working of the scrubbers, stating that he believed the leak in the scrubbers was now remedied. The lime had been permitted to remain in the purifiers longer than it should, and the purifiers had become surcharged. The lime should be more frequently changed.

Mr. FFINCH, who appeared for the gas company, read a report made by Dr. King on the state of the gas-works in the year 1876, which stated that he did not consider the manufacture of gas in the town a nuisance, and asked Dr. King when he had reason to change his mind.

Witness stated that he had reason to change his mind when an immense quantity of ammoniacal liquor was turned into the stream. He did not think that the effluvia arising from the Ilfracombe Gas-Works, particularly during the past six months, were injurious to health so as to cause disease, but he believed them to be a nuisance in the broader sense of the term—they were noxious. He believed when cholera prevailed, the neighbourhood of gas-works was healthy.

Mr. *Pile*, surveyor to the local board, stated that he visited the gas-works the previous week, and saw a lot of lime exposed to the air. The smell was very bad indeed, he being able to smell it in the High Street. The lime was entirely uncovered.

This was the case for the prosecution.

Mr. FFINCH, in addressing the Bench on behalf of the gas company, contended that there had not been a single item of evidence upon which they could rely to convict the company of having created a nuisance; in fact, he claimed the evidence of Dr. Slade-King as being on his side, for he positively stated that the smell was not injurious to health. He himself (Mr. Ffinch) acknowledged that there had been a smell, and that there had been a leakage in the scrubbers, but that was now rectified.

Mr. *Wivell*, chairman of the gas company, stated that in 1872 the company obtained an Act of Parliament, and they then laid out between £5000 and £6000 in remodelling and reconstructing their works.

Mr. *Willey*, gas engineer, of Exeter, stated that he remodelled the gas-works recently, and he considered they were well constructed. He believed the works were well managed, and conducted with the least amount of annoyance to the public. Every possible modern improvement was introduced, and the company had spared no expense to provide themselves with the very best apparatus. It would be unwise to cover over the purifiers, as great danger would arise therefrom. The works for the manufacture of sulphate of ammonia were properly erected, and could, therefore, cause no nuisance. The smell from the works was not, in his opinion, a nuisance.

Mr. *Frederick Child*, manager to the gas company, deposed to having all the best appliances at the works. They had a scrubber with a wooden top, and the heat of the sun had caused an aperture, but that had now been rectified. He lived at the works with his wife and two children, and none of them suffered from any illness. The sulphate of ammonia works were worked for four or five days in December last, and the last time previous to that was in April.

Mr. *Rafarel*, manager of the Barnstaple Gas-Works, deposed that the Ilfracombe Gas-Works were of the most modern construction. He did not think it was practicable to work the saturator with a cover on it, as the cover would have to be removed so many times, as Mr. Child had stated. He could not suggest any improvements at the works. Gas could not be manufactured without a certain amount of smell, but whether that was a nuisance was another question. He had never suffered from the smell himself. He did not know an instance of earth being mixed with lime.

Miss *Dart*, mistress of the National School, close to the gas-works, said she had 170 pupils. She occasionally smelt the gas, but it did not affect her health nor the health of her pupils.

William Harris, who had been a stoker at the gas-works for two years, said he was in very good health, There was a nasty smell sometimes, but it only made him hungry.

William Beer, who looked after the manufacture of sulphate of ammonia, at the Barnstaple Works, said no one enjoyed better health than he did. He could dine at the works.

James Jennings, a gardener, near the works, said his plants and trees were healthy.

Dr. *Blyth*, analytical chemist, said the Ilfracombe Gas-Works seemed to be constructed on the same principles as other gas-works he had gone over. He had made a quantitative analysis of the amount of sulphide of ammonium, which was the principal ingredient evolved from the gas-works. He found that there were 294 grains of ammonium in a million cubic feet of air. Sulphate of ammonia was given as medicine in doses as large as three grains, and he pointed out to the directors that, supposing the purifiers were being emptied during the whole of 24 hours, a man could not possibly take into his system more than 2-25ths of a grain of sulphate of ammonia from the quantity he estimated at the works. With regard to sulphuretted hydrogen, it was his opinion that it did not emanate from the gas-works, except from the saturator; certainly not from the lime, which was complained of. He did not think the smell from the works was injurious to health.

In answer to Mr. THORNE, witness stated that he would recommend the gas company to erect a new purifier, and also to have a covered cart for the purpose of carrying away the refuse lime. It depended on the quantity, whether sulphuretted hydrogen was injurious to health.

Mr. *Richard Lake*, one of the directors, stated there had been no delay in carrying away the lime.

This concluded the case, and Mr. THORNE stated that he did not wish a fine imposed, but he was willing for an order being made that the company should carry out the alterations suggested by Dr. Blyth.

The BENCH asked Mr. Ffinch if the company were willing to carry them out.

Mr. FFINCH said in reality the alterations were being made, but they would undertake nothing. If the magistrates liked to suspend their judgment, and see if the alterations would be carried out, they would see that they were done, but the company would undertake nothing, because he objected to the Court's jurisdiction under the Act.

Mr. THORNE said in that case the magistrates had power to order that the things be done.

Mr. FFINCH complained that the company were brought into Court after the local board knew they were carrying out the suggested alterations.

After some further discussion, the BENCH said they were of opinion, from the evidence, that effluvium prejudicial to health had emanated from the works.

Mr. THORNE then said it was incumbent on him to ask for an order of some kind, and the Bench decided to inflict a fine if the alterations were not carried out. They adjourned the case to the Comb Martin Sessions in May, for the purpose of giving the company time to carry out the improvements, at which sessions they would give their judgment.

RICHMOND PETTY SESSIONS.—WEDNESDAY, MARCH 21.

(*Before Sir* H. PARKER, *Chairman, and a Bench of Magistrates.*)

ALLEGED NUISANCE AT THE RICHMOND GAS-WORKS.

Mr. *James Eldridge*, manager of the Richmond Gas-Works, was summoned, at the instance of the Rural Sanitary Authority, for allowing the Black Horse ditch to be so foul as to be a nuisance and injurious to health.

Mr. J. WOOD, clerk to the Rural Sanitary Authority, appeared in support of the summons, and having opened the case, called

Mr. *James Wigan*, of Cromwell House, Mortlake, who deposed to the noxious smell proceeding from the works, and stated that he wrote to the medical officer, and asked him to bring the matter before the Rural Sanitary Authority. He had heard complaints from others.

Dr. *Adams*, the medical officer, deposed that on several occasions he had observed a nuisance arising from the Black Horse ditch, and on two recent occasions he directly traced it to the gas-works. On Feb. 24 the inspector of nuisances called his attention to the ditch, and they went to the spot. The water in the ditch at Littleworth end was polluted, but the water at the Richmond end was tolerably clear. There was a drain leading from the works, and the contents were running into the ditch. The water produced was taken from the ditch. There was a hole dug about 6 feet away, and a pump and carrier had been rigged up to convey the liquid to the ditch. The liquid was of such a nature as to be a nuisance and injurious to health.

Mr. *T. Davis*, the inspector of nuisances, corroborated, and added that on questioning a workman at the works the man said that the pipe had broken, and they had taken up the ground to put in a new one. He had frequently visited the works, and always found them in a most satisfactory state.

Mr. *Eldridge* did not deny there was a nuisance, but contended that it was the back flow from the ditch, and not from the works at all. He was very careful that fluid like that produced should not escape from the works. He received the summons late on Saturday night, and the connexion was totally cut off on Monday morning by nine o'clock.

The BENCH decided that there was a nuisance, and an order was made for its abatement.

Miscellaneous News.

METROPOLIS GAS SUPPLY.

COURT OF COMMON COUNCIL.—At the meeting of the Council on Thursday last, the Gas Committee reported on the reference to them of the Bill of The Gaslight and Coke Company, and recommended that it should be opposed. The report was agreed to.

METROPOLITAN BOARD OF WORKS.—At the meeting on Friday last, the clerk read a letter from the Vestry of Rotherhithe, stating that complaints have been made as to the quality of the gas supplied in Rotherhithe by the Surrey Consumers Gas Company, and requesting the Board to give instructions to have the gas tested for purity and illuminating power. It was resolved that a reply should be sent to the vestry, informing them that the Surrey Consumers Company are not under the control of the Board, but that the vestry themselves have the power, by the 27th section of the Metropolis Gas Act, 1860, to cause the gas to be tested. A letter was read from the Board of Trade stating that in the event of the Bill of The Gaslight and Coke Company not receiving the sanction of Parliament, the Board will be prepared to consider the advisability of introducing a short Bill, for the purpose of removing the difficulty pointed out by the Gas Referees as to specifying the station from which gas is delivered before forfeiture for defective illuminating power can be recovered. Another letter also was read from the Board of Trade, referring to their letter of the 11th of December last, and copy of correspondence with The Gaslight and Coke Company, relative to the nuisance alleged to be caused by the purification of gas by means of lime; and transmitting copy of correspondence between the Board of Trade and the Gas Referees in regard to the purification of gas from sulphur. Both communications were referred to the Works and General Purposes Committee.

BERMONDSEY VESTRY.—At the meeting of the vestry on the 19th inst., complaints were made of the trouble and annoyance given by the Surrey Consumers Gas Company. Owing to the great number of lamps allotted to each man, it was impossible for the work of cleaning them to be done satisfactorily. The defects in the nipples and regulators were scarcely or never removed, thus diminishing the consumption of gas. Bills were often stuck upon the posts, but the company never took any steps to remove them. The glass of the lanterns was often broken, but the company never prosecuted the offenders, so that constant repairing of the lanterns was necessary. The clerk said he trusted the vestry would adopt some measure that would assist him in placing the district in the same position as those districts supplied by the Phœnix and South Metropolitan Gas Companies. It was decided that the clerk should inquire into and report upon the matter.

METROPOLIS WATER SUPPLY.

Major Bolton reports that the state of the water in the Thames and Lea was indifferent during the month of February. The water taken in being muddy and turbid. The water in the river Thames at Hampton, Molesey, and Sunbury (where the intakes of the West Middlesex, Grand Junction, Southwark and Vauxhall, Lambeth, Chelsea, and East London Companies are situated), was turbid and coloured during the whole of the month of February. The highest flood state of the river was 2 feet 10 inches above the (6 feet) summer level, and the lowest was 1 foot above summer level. The highest temperature of the water taken at Seething Wells was 48°, and the lowest 40°, while the highest temperature of the air at the same place was 57°, and the lowest 33°. The condition of the water in this part of the river was indifferent throughout the month. The highest flood state was 4 feet 2 inches above, and the lowest 2 feet above summer level. These observatione were made daily at 9 a.m. The rainfall for the month was 1·89 inches.

WATER SUPPLY OF CHAPELTOWN.—It was announced some time ago in these notes that the Sheffield Water-Works Company had agreed to supply the township of Chapeltown with water delivered in a tank at Potter's Hill, at the maximum rate of 7½d. per 1000 gallons. The township itself will provide and lay the supply pipes from the tank. We are now enabled to state that Messrs. Newton, Chambers, and Co., of the Thorncliffe Iron-Works, have received orders to make the pipes, which will be required to traverse the five miles or so between Sheffield and Potter's Hill, and that the work will be at once proceeded with.—*Engineering.*

LEGACIES TO GAS WORKMEN.—The *South-Eastern Gazette* says: "An interesting incident has taken place at the Margate works of the Isle of Thanet Gas Company, in connexion with the bequest by the late Mr. Barker of £5 each to the stokers, lamplighters, and others there employed. The deceased gentleman had left written directions that the men should be assembled to receive the legacies, and that previous to their distribution a paper which he had left should be read to them. The tenor of this message was that he (Mr. Barker) having found by experience the great advantage of carefulness in the employment of money, hoped that the recipients of this mark of his interest in their welfare would invest it in the Savings Bank, and that it might prove the nucleus of future savings, as a store against a rainy day. The men, eighteen in number, were accordingly gathered at the gas-works, King Street, on Saturday, the 3rd inst., when the testator's directions were carried out by the executors, who handed to each of the men a £5 note."

CAGLIARI GAS AND WATER COMPANY, LIMITED.

The Ordinary General Meeting of the Shareholders of this Company was held at the Offices, No. 3, Lothbury, London, on Tuesday, March 20—Erasmus Wilson, Esq., F.R.S., in the chair.

The Secretary (Mr. Rod. Mackay) read the notice convening the meeting, and the following report and statement of accounts were submitted:—

The receipts on revenue account for the past year amount to £17,434 14s. 8d., and the expenditure to £8161 14s. 1d., leaving a clear net revenue for the year of £9273 0s. 7d.

The amount available for dividend, including the balance brought forward from the previous year, as shown on the balance-sheet, is		£10,661 5 7
Out of which an interim dividend at the rate of 5 per cent. per annum was paid for the half year ending June 30, 1876.	£3,596 10 0	
The directors recommend a dividend at the rate of 7 per cent. per annum for the half year ending Dec. 31, 1876, amounting to	5,056 2 0	
		8,652 12 0
Leaving a balance to be carried forward to next year's account of . . .		£2,008 13 7

The water receipts for the year show an increase of £182 7s. 4d. over those of the previous year.

The gas receipts for the year show an increase of £216 14s. 7d.

The loss from gas leakage has averaged 9 per cent. of the make over the whole year.

The amount paid for rates and taxes in Cagliari during the year, and the loss of exchange on remittances to this country during the year, still press somewhat heavily on this company.

It will be seen that during the past year £7500 has been raised by the issue of debenture bonds bearing interest at 6 per cent. per annum. The mortgage for £5000 previously existing has been discharged.

The directors retiring by rotation are Mr. John James Barrow and Mr. Joseph Quick, who, being eligible, offer themselves for re-election.

Dr. *Revenue Account, for the Year ending Dec. 31, 1876.* *Cr.*

Expenditure.				Receipts.			
Maintenance of water-works—				Water—			
Reservoirs and filters in Corungiu	£87	17	5	The Italian Government, Province of Cagliari and Municipality of Cagliari .	*9,600	0	0
Main to town	24	18	10				
Reservrs. & mains in Cagliari	85	3	6				
Horse keep & miscellaneous	112	1	6				
Gas manufacture—							
Wages	727	7	7				
Coals.	1,923	6	10				
Stores	278	5	7				
General charges in Cagliari—							
Salaries	1,279	2	0				
Office rent, stationery, travelling expenses, &c. . . .	228	19	0				
Rates and taxes in Cagliari.	871	15	6				
General charges in London—							
Directors and auditors fees .	281	10	0				
Salaries and office rent . .	250	0	0				
Stationery, bill stamps, and petty disbursements . .	83	18	8				
Prem. on insurance of works	30	0	0				
Exchange on remittances . .	1,220	10	8				
Interest and discounts . . .	426	17	0				
Sinking-fund.	150	0	0				
Reserve-fund.	100	0	0				
Balance—Net profit for year carried to gen. balance sheet	9,273	0	7				
	£17,434	14	8		£17,434	14	8

* By the 11th Article of the Concession, the fixed annual payment for the water supply in Cagliari is:—For the first 30 years, from 1867 to 1897, £9600; second 30 years, from 1897 to 1927, £7600; third 30 years, from 1927 to 1957, £5600.

				From sundry customers, viz.—			
				For extra supply in Cagliari.	1,282	17	4
				For supply beyond Cagliari.	580	18	6
				For supply to shipping . .	67	7	3
				Gas—			
				Public lamps	1,822	3	9
				Private lights	2,035	0	8
				Products	1,445	18	4
				Transfer fees	4	0	0
				Sundry work and sales of material	596	8	10

Capital Account and Balance-Sheet, Dec. 31, 1876.

Gas and Water-Works—				Capital, authorized by Memorandum and Articles of Association, 7500 shares of £20 each	£150,000	0	0
Total amount expended, including preliminary expenses, to Dec. 31, 1875, per last account . .	£150,472	8	0				
Expended during year . .	697	19	11				
Cash at company's bankers .	416	19	2	7223 shares, subscribed to Dec. 31, 1876.	144,460	0	0
Bills receivable.	230	8	7	Debenture bonds	7,500	0	0
Stores on hand at Cagliari—				Sundry debts due by company	1,953	1	8
Coals	199	16	0	Bills payable	889	11	6
Products	160	4	0	Sinking-fund	1,839	9	8
Sundry debts due to the company	6,706	16	10	Special reserve-fund . . .	200	0	0
Special works executed . .	1,805	11	0	Revenue account, net profits—			
Goods in transit	1,216	14	11	Balance at Dec. 31, 1875 . . £9,300 11 0			
Investment in share capital of company (sinking-fund)	1,800	0	0	Less div. paid for the year 1875 7,912 6 0			
Investment in share capital of company (special reserve-fund)	200	0	0	£1,388 5 0			
Payment on account of dividend, Oct. 9, 1876 . . .	3,596	10	0	Year to Dec. 31, 1876 . . . 9,273 0 7	10,661	5	7
	£167,503	8	5		£167,503	8	5

The Chairman, in moving the adoption of the report, said he was happy to be able to inform the shareholders that the affairs of the company were going on in a satisfactory manner, and that they were doing as well as they had any reason to expect. They did not anticipate making that progress in a foreign country which might naturally be looked for at home, nor did they calculate upon presenting such enormous figures as might perchance be reckoned upon in their own country. But taking the separate items which constituted the balance-sheet of this undertaking, he thought the meeting would agree that there had been a very satisfactory increase, though not a very large one, in the receipts for water, while the gas receipts, which last year left a balance against the company, in consequence of the reduction made in the price charged to consumers, now exhibited a balance in their favour. Added to this was the fact that the loss by leakage had been considerably diminished, averaging now only 9 per cent. in lieu of 11½. There still remained the old difficulty with regard to rates and taxes, and loss by exchange on remittances to this country, but in reference to the latter he was in hope that time would produce some amelioration. He need not say that any explanation concerning the accounts, or as to the state of the company, would be willingly furnished to the shareholders, particularly on the present occasion, when he had the opportunity of introducing to the meeting their much trusted and highly esteemed engineer and manager, Mr. Simmelkjor, who was now on a visit to England. The directors had had a conference with Mr. Simmelkjor that morning, with a view to a further extension of the company with reference to the water supply of Cagliari. Mr. Simmelkjor had the most thorough mastery of all the intricacies of the company's undertaking; he had been with them from the beginning, and had always had the fullest confidence of the board.

Mr. John Aird seconded the motion, which was put and carried unanimously.

The Chairman moved—"That the interim payment on account of dividend on the 9th of October last be and is hereby confirmed, and that a dividend for the half year ending Dec. 31, 1876, at the rate of 7 per cent. per annum, less income-tax, be declared payable on and after the 7th of April next."

Mr. H. P. Stephenson seconded the motion, which was put and carried.

The retiring directors and auditors were re-elected.

Mr. Simmelkjor, on the invitation of the chairman, addressed the meeting. He said he would in a few words give a history of the company up to the present time. The company were formed for the purpose of supplying both water and gas. As to the supply of water, that had always proved to be the chief part of the undertaking, and had required the largest part of the capital to be embarked in it. In a hot country like Cagliari, the demand for water would always be more than for gas. The concession obtained by the company was for the supply of a certain quantity of water to the town free of charge—so much in the summer, and so much in the winter months. For that supply the company were to receive £9600 sterling each year. The company, however, were desirous of increasing their revenue from this portion of their undertaking, and they proposed to the town to lay on the water to the houses of the inhabitants, because the payment of the £9600 was only for a certain number of taps in certain places. But the proposal was simply laughed at; the people said, "We have 150 public taps in the streets, and we do not care to have water brought into the houses." A year or two passed away, and the company had only the £9600 as revenue from the water supply; but, after all, they obtained permission to lay water on to certain houses at a certain rate. When the town came to see that something was to be made out of this, they began to think they should like to get some of the money, and they set the lawyers to look at the concession. They then found it was illegal, because the concession said the company were only to supply water to the Municipality and local authority, so that they had no right to supply the householders. The authorities accordingly gave the company orders at once to discontinue the supply, and said they would take it upon themselves. This would have been a serious matter to the company; but, fortunately, all the mains and all the works belonged to them; so they said to the town, "You may go on supplying the people and the houses, but we cannot let you do it through our pipes." They were obliged then to see that the company were right, and, therefore, they asked them to come to some arrangement. The result was that, after long negotiations, the company and the authorities came to their present agreement, which was to the effect that the company supplied water to the houses of the inhabitants, charging according to a rate which the authorities put on it, they taking one-half the amount produced, and the company the other half. This arrangement was entered into three years ago, and, under it, the company received last year £1300 sterling—a sum which would increase every year in future. At the present time very few houses were fitted up; but as the inhabitants began to feel the benefit of this extra supply, the company's revenue would be larger, while the expenditure upon the company's works had a tendency to decrease, which he considered was a good feature. In fact, the works had been so constructed that, whether supplying 10,000 or 100,000 gallons a day, the cost was the same. It was all a gravitation scheme; there was no pumping, so that, if more water was required, it was only necessary to open the tap a little wider. At present the company's reservoirs were so very large, that even when rain fell during the month of October, not more than one-third their capacity was utilized. And even if they were filled, it would be easy to add another 15 feet to their height, so that, for his part, he felt sure that during the 90 years of the company's concession it would not be necessary to spend more capital on extensions in that direction; nor would it be required to expend more than £300 a year for maintenance, workmen's expenses, and everything else. The chairman had mentioned the fact that there had been some little difficulties in reference to rates and taxes, and the rate of exchange. No doubt this was very disagreeable as long as it lasted. The Italian finances were in a very low state, and they had to put on very heavy taxes; but even in this matter the company were very fortunate in getting their taxes reduced, although still very high. As to the gas-works, he might remark that Cagliari, like most Italian towns, did not consume much gas. People lived very much in the *cafés* and streets, and there were no large theatres or public buildings to be lighted. It, therefore, took some time to introduce gas, and to obtain from its supply such a return as they could wish. The gas-works belonging to this company had been built very large—a fault, but a fault in the right direction—so large, indeed, that they would never be called upon to spend a farthing more capital upon them during the concession. There were eight retort-beds, with five retorts in each, and as yet there had never been more than three beds lighted during the longest day's consumption. In the same retort-house there was room for eight more beds, and there was also one gasholder not yet in use. The greatest profit from the gas-works was in the sale of coke, the company having been very fortunate in introducing the use of coke into people's houses. It was all sold by retail, and realized as much as £2 per ton. At the same time freights out to Cagliari were always very low, much lower than to other Italian towns, the Government having large salt and iron works there. The last cargo of coals shipped—Pelaw Main—cost into the retort-house 21s. 5d. per ton, and as the coke yielded £2 per ton, this was a satisfactory state of things. As for tar, there was little use for it, and it was generally burned under the retorts. The ammoniacal liquor was thrown away, there being no market at all for that product. To encourage the sale of gas he had supplied fittings on hire, and in that way had obtained many customers. Latterly he had commenced selling fittings at a reduced price, even at a small loss to the company, because he found that some persons who had been supplied with them on hire discontinued the use of gas after a few months, and he thought if they had fittings of their own they would be induced to go on with it. He did not know that he could furnish further information, but would be very happy to answer any questions that might be put to him.

Mr. H. P. Stephenson said he thought the shareholders would be wanting in courtesy if they allowed the present opportunity to pass without passing a special vote of thanks to Mr. Simmelkjor, for the energy and perseverance he had shown in the conduct of the affairs of the company at Cagliari. He thought the settlement effected by Mr. Simmelkjor with the Municipality, with reference to the supply of water to private houses, was a most satisfactory one. But for that arrangement, he felt sure the company would not have progressed as they had done, but would have continued to pay only 4 or 5 per cent. as they did some years ago. He had much pleasure in moving a special vote of thanks to their engineer and manager for the ability and energy with which he had conducted the business of the company.

The motion having been seconded,

The Chairman said it was a most worthy vote to a most worthy man, and it was very satisfactory to think that the proposal came from the shareholders as it had done. He was sure Mr. Simmelkjor would carry back to his own country a pleasant recollection of the manner in which his services had been recognized.

The vote was very cordially adopted.

Mr. Simmelkjor said he was much obliged for the kindness thus shown to him. In his country it was a saying that good masters made good servants. He could only say that it had always been a pleasure to him to carry out to the best of his ability the instructions received from the board of this company.

A vote of thanks was then given to the chairman and directors, and the proceedings terminated.

COLNEY HATCH GAS COMPANY.

The Half-Yearly Meeting of Shareholders in this Company was held on Friday, the 16th inst., at the Works, New Southgate—Mr. G. K. Smith, chairman, presiding.

The Secretary (Mr. W. H. Hardy) read the notice convening the meeting.

The following report was submitted:—

The directors herewith present to you the audited accounts of the company for the half year ending Dec. 31, 1876. A satisfactory improvement is shown in comparison with the accounts for the corresponding period of the year 1875.

The directors have to report that shortly after the last ordinary meeting of the company they had reason to suspect the accounts of their late accountant, W. H. Wood, who absconded upon the institution of a strict investigation of the whole of the company's books. Defalcations were ultimately disclosed amounting to £860 9s. 2d., and of this sum £600 belonged to accounts of periods previous to June, 1876. Although the directors felt they were in no degree liable for these losses (and were so advised by counsel), they thought fit, for several reasons, in the interests of the company, to put beyond question the accounts which had been passed by the company in general meeting, and, therefore, decided upon subscribing among themselves the sum of £600, and this sum has been paid to the credit of the company. The remainder, or loss, being £172 4s. 11d., has been charged against revenue in the accounts now before you.

From the profits available for division, the directors recommend you to declare a dividend at the rate of 4 per cent. per annum, free of income-tax, and payable on the 4th of April next.

Dr. *Revenue Account, for the Half Year ended Dec. 31, 1876.* *Cr.*

Manufacture of gas—				Sale of gas—		
Coals	£975	19	4	At 5s. per 1000 cubic feet	£690	1 6
Purifying materials	44	12	8	At 6s. per 1000 ,,	1690	17 3
Wages	276	7	0	Meter-rental	81	2 3
Repairs and maintenance of works and plant, including renewal of retorts, &c.	65	13	2	Residual products—		
				Coke	279	2 1
Distribution of gas—				Tar and lime	127	18 2
Repair, maintenance, and renewal of mains and service-pipes	3	1	10	Services	6	17 4
Repairing, renewing, and re-fixing meters	7	10	6			
Rates and taxes	111	17	11			
Management—						
Salaries of secretary, accountant, and collector	131	13	4			
Stationery, printing, & general establishment charges	148	1	5			
Directors fees to Oct., 1876	50	0	0			
Auditor	5	5	0			
Bad debts and allowances	89	11	7			
Defalcations of late accountant £860 9 2						
Less amts. not charged to consumers, since recovered. £88 4 3						
Less subscribed by directors 600 0 0	688	4	3			
	172	4	11			
Total expenditure	£2081	18	8			
Balance carried to profit and loss account	793	19	11			
	£2875	18	7		£2875	18 7

The Chairman, in moving the adoption of the report, said he had a most unpleasant task before him, more especially as the past six months had been one of great anxiety to himself and co-directors. He alluded to the defalcations of the late assistant secretary. He hoped that the course the directors had adopted, and the way in which they had dealt with this painful business in a financial point of view, would meet with the approval of the proprietors. The business of the company in other respects was progressive, and was steadily increasing.

Mr. J. B. Paddon, in seconding the report, gave a very satisfactory explanation of the accounts, and stated that, although the company had been so unfortunate, he still was sanguine for their future success. Although the price of gas had been increased to 6s. per 1000 feet, the distribution of gas had increased nearly 10 per cent. The results obtained during the past half year showed a great improvement on former years, notwithstanding the drawback from the low price obtained for residuals. The frauds committed by Wood, who had been eleven years in the service of the Brighton and Hove Gas Company, were carried out in a systematic manner, and, although for some time such proceedings escape detection, yet eventually they come to light. Wood had two modes of carrying out his purpose—first, by using false and duplicate books, placing the spurious ones before the auditor; and, secondly, paying one account under the other, and thus the customers in arrears one quarter for gas or coke did not appear the next. However, as the local press had given great publicity to the affair, he would not add any further details. The directors felt themselves morally bound to replace the amount of defalcation as exhibited and discovered to the 30th of June, 1876, and thus place the company's affairs under this head in a sound condition by paying off the whole amount.

Several Proprietors inquired the probable extent of loss to be incurred from Wood's frauds.

Mr. E. Homan replied by stating that the present balance-sheet showed the entire loss, and the company would not be called upon to pay a single penny expense for the prosecution. Wood had been captured, and was now on his way home.

On the motion of Mr. Clark, a vote of thanks was passed to the chairman and directors; and, on the motion of Mr. Homan, the thanks of the shareholders were conveyed to the secretary, for the able and energetic manner in which he had dealt with the accounts in the face of the difficulties he had to contend with.

Mr. Paddon, in moving that a vote of thanks be given to the auditor, stated that the proprietors might rely upon the work being efficiently performed. The directors expressed every confidence in Mr. Randall, from his practical experience and knowledge of accounts, and his long connexion with a neighbouring gas company.

A vote of thanks was also accorded to Mr. Oatley, the manager, for his services to the company.

MELBOURNE (AUSTRALIA) GAS AND COKE COMPANY.

A Special General Meeting of Shareholders was held at the Company's Office, Collins Street West, Melbourne, on Tuesday, Jan. 23—Mr. T. Mowbray in the chair.

The Secretary (Mr. John Scott) read the following report:—

Your directors submit the usual audited statement of accounts for the year ended Dec. 31, 1876.

The general reduction in the price of gas to 7s. 6d., which took effect on the 1st of July last, has, of course, diminished the revenue from that source, although, taken as a whole, under the circumstances, results, it is thought, will not be considered unsatisfactory.

The half year's working, with the balance brought forward, has left at credit of profit and loss £9317 5s. 9d., from which a dividend was declared at the rate of 6 per cent. per annum, absorbing £7500, leaving unappropriated and carried forward to the next half year £1817 5s. 9d.

The works have been carefully maintained in an efficient state, and operations throughout have been conducted with economy and regularity.

The construction of an out-station gasholder, for the better supply of districts south of the Yarra, is being pushed forward diligently, and will, it is confidently expected, be available for next winter's requirements.

Dr. *Revenue Account, for the Half Year ending Dec. 31, 1876.* *Cr.*

Apparatus, &c.	£4,140	7	2	Gas-rates	£43,623	18 3
Stationery, printing, and advertising	233	8	6	Residual products—		
General charges	10,625	17	4	Coke	5,166	17 8
Repairs	593	7	11	Tar, &c.	2,679	3 9
Coal purchased	20,240	4	10	Deposits from contractors and others	216	10 0
Lime purchased	719	7	9	Commercial Bank, June 30, 1876	7,568	2 1
Dividends to shareholders	7,589	2	0	Cash on hand, June 30, 1876	404	15 2
Interest on debentures	750	0	0			
Deposits refunded	214	15	0			
Commercial Bank, Dec. 31, 1876	13,700	13	2			
Cash on hand, Dec. 31, 1876	256	3	3			
	£59,063	6	11		£59,063	6 11

The Chairman moved the adoption of the report and balance-sheet, and in doing so said the directors considered the financial position of the company was very satisfactory. Their constant aim had been to carry on the works with economy and efficiency, and in this object they had been ably seconded by the secretary, Mr. Scott, and the manager, Mr. Kelly. The directors had entered into a very satisfactory contract for coal for the incoming year, and altogether the affairs of the company were much more satisfactory than at the meeting in July last.

Mr. B. Benjamin seconded the motion, which was carried unanimously.

Mr. W. H. Cropper drew the attention of the chairman to the large sum of money owing to the company by consumers, and suggested that an allowance of 5 per cent. should be made to consumers who paid their accounts with in the month, so as to encourage them to pay their accounts more readily.

The Chairman said the suggestion should receive the consideration of the directors.

After a vote of thanks to the directors, the meeting adjourned.

SILBER LIGHT COMPANY, LIMITED.

The Ordinary General Meeting of this Company, was held on Thursday, the 16th inst., at the Victoria Rooms, Queen Victoria Street, London—Mr. R. J. Jenkins in the chair.

The following report of the directors was presented:—

The directors beg to submit to the shareholders the fourth yearly report on the business of the company, with general balance-sheet, audited to Feb. 28, 1877, and regret the aspect of affairs as presented.

The gross profits, including £381 13s. brought forward from last account, and interest and transfer fees received, amount to £9151 2s. 6d.; from this a reduction has to be made of £6617 10s. 3d. for depreciation in the value of the stock on hand; the directors and auditors remuneration and working expenses (including balance of discount account and bad debt account), amount, as shown in profit and loss account, to £2358 13s. 8d., against £11,339 1s. for the preceding year, and with a provision of £300 to meet anticipated losses on doubtful debts, and £375 written off preliminary expenses and £289 3s. 4d. (being 10 per cent.) off fixture account, there shows a deficit of £7989 4s. 9d.

There has been a considerable diminution in the amount of the sales, consequent upon the great depression of trade, which has been generally experienced during the past year.

The directors think, however, that, with the great improvement which has been effected in the articles from which the company has hitherto derived its principal revenue, and various other facilities which have been introduced for the better development of the business, should there be a revival in trade, there is every prospect of the business of the company greatly improving during the current year.

The directors regret to have to inform the shareholders that, owing to prolonged and serious illness, Sir John Farquhar, Bart., has been compelled to vacate his seat at the board. The vacancy so caused was filled by the appointment of Major Brackenbury, who, however, found it inconvenient to attend the board meetings, and he has consequently resigned.

At this meeting one director (R. J. Jenkins, Esq.) retires by rotation, according to the Articles of Association, and, being eligible, offers himself for re-election.

The auditor (Frederick Maynard, Esq.) also retires, and offers himself for re-appointment. The remuneration of the auditor will have to be fixed by the meeting.

The Chairman, in moving the adoption of the report, expressed the deep regret of the board at the resignation of Sir John Farquhar, through prolonged illness, and of Major Brackenbury, who was appointed to the vacancy so occasioned, through his other engagements. The directors very much regretted that the accounts for the financial year ending Feb. 28 last, showed a loss of £7989 4s. 9d., the principal part of which had been caused by the large amount which was necessary to be written off for depreciation of stock. This loss was the more disappointing, because he could assure them that the directors had given their most earnest attention to the company's business, to extending their operations, and reducing the expenses. They might say the expenses were still very high, but in a business of this sort they must provide not only for the present business, but for possible business. The expenses were almost precisely the same as last year, but they would observe that there was £954 for advertising, which had been incurred in consequence of an expression of opinion at the last meeting, that it would be well to bring the company more before the public. In this respect the results up to the present time had been disappointing, but he hoped they would have better results in future. Last year the sum appearing as directors remuneration was £1625, and this year it was £256; he himself was the only director receiving remuneration at the present time, and as a business man, giving up his time, he considered that he was entitled to some recompense. The other directors (Mr. Andrade and Mr. Silber) had given their services for nothing. The great depression of trade generally during the past year had very adversely affected the company; the shipping branch, one of the most profitable, had changed very much in its character, and cheaper lamps were now used in place of the former expensive lamps, which were so profitable to the company. There had been a rise in petroleum of 200 or 300 per cent., which was a very important item to the company, more particularly as the price of gas had decreased as the price of petroleum had risen. Under these circumstances, he thought the reduction in the gross profits was satisfactorily accounted for. There was an amount placed to suspense account, in connexion with the case of *Sugg v. Silber*, but it would be unwise to discuss that question on this occasion. He believed there was a future for the company, and he could only say the directors would use their best exertions to bring about success.

Mr. Silber (managing director), in seconding the motion, referred to the system of conveying oil through pipes, which the company had not at present brought into operation, excepting upon their own premises. He had used this system at his house of business for nearly three years prior to the incorporation of the company; and they had had it in constant use at Whitecross Street ever since they took possession there in 1873. Before they could so use it, they obtained the consent of the leading insurance companies in which their premises and stock were insured; and they also obtained their permission to keep three barrels of petroleum without any enhancement of premium. When, however, in consequence of the development of their business, they were compelled to increase their warehouse accommodation in Beech Lane, they were prevented from laying on oil-pipes there in consequence of the insurance companies having demanded a prohibitory premium. This and other minor causes had been contributory to the neglect of a contrivance which was not likely to lead

to any immediate profitable result, although the admirable way in which this system of lighting had answered confirmed his own opinion that the patent was a valuable one. Similar objections were raised by the insurance companies at the time of the introduction of gas into this country, and before even the smallest gas-fitting could be removed from one part of a room to another, the inspectors of the insurance companies had to indorse every such change upon the policy. They all knew that there was a certain amount of danger from gas in every house where it was laid on; but it was a recognized fact that, with ordinary care, this danger might be reduced to an insignificant minimum. He had done his best to convince the directors of the several insurance companies that the dangers attendant upon "laying on of oil" were certainly no greater than those of gas; but, to his great disappointment, he had been completely unsuccessful. Passing on now to the departmental divisions of the business, he might say that the perfecting of railway carriage roof-lamps, and adapting them to all carriages, had had his first and chief attention; and, after having been successful in so constructing these lamps that either light or heavy mineral oils could be burned in them, it was disappointing that, for some reason (still unaccountable to him), the oil in the glass of one of the lamps ignited—a circumstance which had seriously interfered with their sale. Nevertheless, the company had since sold a considerable quantity for other purposes, and it was gratifying to know that they had given the greatest satisfaction. Their signal, station, tail, head, and other railway lamps, burning mineral oils, were now introduced on some of the principal railway lines, and the repetition orders which they received for them were the best proofs of their excellence. Still, taking into consideration the whole of the business done by them with railway companies during the four years of their trading, he was of opinion that they had made no profit in this direction. However, they had now no further experiments to make in this department, and hence he was under the impression that a profit would ultimately be made, if the sales continued to increase as they had done of late, and if the lamps were adopted by the companies which had been trying them for two years with success. It had required more than ordinary patience and perseverance, besides an extensive outlay of capital, to obtain even the small measure of success which had attended their efforts in this direction. He could only speak in the same disparaging manner of the business yet done with their ship lamps, but he was bound to observe that he was hopeful for the future of that department. Passing on to the department for the sale of lamps for domestic purposes, to which their utmost energy had been directed, and deducting the loss written off in the balance-sheet, without calculating or including the loss sustained by the non-paying departments, they had earned in this department alone, during the course of their four years trading, the whole of the profits which had been divided. During the season of the year 1874 they were able to sell their lamps almost as fast as they could procure them, and at their own prices; and at that time they had only a limited staff, and but one or two travellers. Then, too, they only sold their best moderator and double air-current petroleum lamps, and he was sorry to admit, with regard to the latter, that the construction was such, although every lamp was tried with a properly constructed air-pump before being sent out, that many leaked after being in use for only a day or two—a circumstance which naturally militated against the company. They then introduced a burner which gave about the same illumination as that given by the double air-current lamp, but which could be affixed to any description of oil container, thus obviating the leakage difficulty; yet, notwithstanding the fact that this burner possessed all the advantages which they claimed for it, and although they sold over 60,000 of them, a difficulty in adjusting the wick proved an objection, and, as a natural consequence, the sale of those lamps fell off. Their trade in best lamps underwent an entire change in the year 1875. The best and largest houses, which alone could buy good lamps, would only buy their burners from the company, and imported their lamps themselves. For some time they declined to supply them with burners only; but they were mortified to find that the parties referred to purchased the very cheapest lamps, and stripped them of their burners in order to attach them to their own lamps of better class. Many thousands of their petroleum lamps were sent to the colonies; and these, possessing the defects he had already pointed out, injured the reputation of the company as lamp makers, in a market which they had hoped would prove the most profitable. In the month of June, 1875, they introduced their new burner, in which the objections to the former burner had been surmounted. The new burner appeared to give general satisfaction, but, unhappily, the mischief was done. Shopkeepers had had their burners returned to them to be trimmed, repaired, and exchanged, and, consequently, had lost faith in their goods. As a result of those untoward circumstances, their trade, instead of increasing, showed a continued falling off, especially from October, 1875, to about the same period of 1876. To induce a trade in this country, and to introduce the new burner, they had to sell at very moderate profits; and to recover lost ground they had to send special travellers to every part of Great Britain and Ireland, so that they might give ocular demonstration of the improved manufactures to those of their customers who had lost faith in them. He might remark that a gratifying proof of the success of this new burner was afforded by the fact that complaints were now very rare indeed, but the sale was still very small. After referring to the large interest held in the company by himself and friends, and the efforts and sacrifices he had himself made to make the company a success, he proceeded to give further details of the difficulties attending the conduct of the business. With regard to the future, he anticipated an increased trade in railway lamps, as well as in ship lamps, but he thought it doubtful whether the profit to be derived would be beneficial. Trade in the cheaper kinds of domestic lamps was well organized, and the company were in a fair way to an increase in that branch. He anticipated that their expenses would be much less than during the past year. The stock would be decreased, and, if the trade was not worse than last year, they must be gainers; so that, on the whole, he thought they would be in a better position before that day twelvemonth. Should he be obliged to change his opinion then or before, he would not lose a moment in advising the board to call a special meeting at which to lay the position of the company fully before the shareholders. He concluded by referring to a private meeting of shareholders held a day or two previously, and strongly animadverted upon the conduct of certain parties who, he said, had bought a few shares with the evident intention of trying to wreck the company; and the question for the shareholder was whether they would support the directors, who were doing their best to promote the welfare of the company, or whether they would support those persons who were trying to ruin it. He and his co-directors held 7000 votes out of 12,000, but they should not use them to influence the decision of the shareholders in any way. He had a very large interest in the company, and it was his interest to see it go on and prosper, and he hoped, with a return of general prosperity, there would be a future for the company.

Mr. F. Maynard, the auditor, bore testimony to the clear and correct manner in which the books were kept.

Mr. White said he had no reason to do otherwise than respect Mr. Silber, but he must say he was extremely disappointed with the report, and he thought that some stringent investigation was required. He did not advocate winding-up, but thought a committee should be appointed. He moved an amendment, appointing a committee to investigate the books of the company, with power to add to their number, and deferring the passing of the accounts till the committee's report was presented to an adjourned meeting.

Mr. M'Naghten seconded the amendment, which, after a long discussion, was put to the meeting and lost, and the original resolution was then carried, with four dissentients.

The retiring director and auditor having been re-elected, the proceedings terminated.

BRIGHTON AND HOVE GENERAL GAS COMPANY.

The following statements of account for last year have just been published:—

Dr.—Profit and Loss, for the Year ending Dec. 31, 1876.

To Coals		£25,271	14 9
Purifying materials and process		836	1 11
Repair and maintenance of meters, mains, service-pipes, and other works		4,850	9 11
Wages		8,090	1 2
Lamps—providing, lighting, extinguishing, cleaning, and repairing		460	16 6
Rent, rates, and taxes		1,022	4 9
Salaries, collectors commissions, and payments to directors		4,296	5 6
Interest on loans		2,334	6 4
Professional charges and incidental expenses		189	5 6
Estimated discounts and bad debts on rental		224	12 0
Dividends paid to proprietors, viz.—			

Per Cent.	On Capital. Paid Up.	Class.	Raised under Act.	Amnt.		
9½	£100,000	Original ordinary	Vict. 2, c. 38	£9,500		
7	25,000	A ordinary	„ 29, c. 184	1,750		
6	50,000	B preference	„ 29, c. 184	3,000		
					14,250	0 0
Balance carried to next year's account					11,615	14 3
					£73,441	12 7

Cr.—Profit and Loss.

By Balance brought from last year's account	£8,802	17 2
Sale of gas	50,504	2 2
Coke and breeze	10,280	9 3
Tar and other residuals	3,854	4 0
	£73,441	12 7

Dr.—Balance-Sheet.

To Capital raised under Act—				
Vic. 2, c. 38, original ordinary shares	£100,000	0	0	
Vic. 29, c. 184, A ordinary shares	25,000	0	0	
Vic. 29, c. 184, B preference shares	50,000	0	0	
				£175,000 0 0
Debenture stock				45,000 0 0
Amount of loans				12,000 0 0
Reserve-fund				1,810 13 2
Capital in trade				6,210 4 6
Amount owing by company				3,202 17 11
Unclaimed dividends				310 18 0
Balance, as above				11,615 14 3
				£255,150 8 0

Cr.—Balance-Sheet.

By Cost of works to Dec. 31, 1875	£204,686	3	2	
Ditto (add extensions made during the year)	11,194	2	8	
				£215,880 5 10
Amount owing to the company for gas, coke, residual products, &c., exclusive of estimated bad debts				21,666 6 2
Coals in stock				3,268 0 9
Residual products and other stocks				1,197 11 2
Cash in hands of treasurer, cashier, &c.	£3,494	8	9	
Cash advanced on account of contracts	9,643	15	4	
				13,138 4 1
				£255,150 8 0

Testimonial to Mr. R. W. Egg, of Dartmouth.—On Wednesday evening, March 14, the directors of the Dartmouth Gas Company, with a number of other gentlemen, took supper together at the Castle Hotel, on the occasion of the presentation of a testimonial to Mr. Richard Webber Egg, in recognition of his valuable services as managing director, on his retirement from that office, after having fulfilled its duties for a period of nearly twenty years. The meeting was also made the occasion of acknowledging the long and able services of Mr. R. W. Creed, chairman of directors, who had also announced his intention of retiring from the duties of that office. Mr. R. W. Creed, presided, the vice-chair being filled by Mr. R. Cranford, secretary of the company. The mayor and other influential persons in the town were amongst the guests. The chairman, in making the presentation, said Mr. Egg had been connected with the gas company since the commencement, and they all knew with what zeal and ability he had carried out the duties of the office, and how much his services had contributed to the success of the company. He (the chairman) had much pleasure in handing the testimonial to Mr. Egg, and hoped he would live long to enjoy it. The testimonial consisted of a handsome English lever gold watch, by Benson, London, on which was engraved the following inscription:—"Presented to Richard W. Egg. Esq., by the directors, shareholders, and staff of the Dartmouth Gas Company, on his retirement as managing director, after eighteen years satisfactory service. —1876." Attached to the watch was a massive Albert eighteen-carat gold chain, both being enclosed in a suitable morocco leatnercase. This handsome present was accompanied by a purse of 15 sovereigns. Mr. Egg, in acknowledging the gift, and the graceful manner in which it had been presented, expressed the satisfaction he felt in knowing that the list of subscribers contained the names of many of the workmen who had worked under him, and were still doing so. Referring to the progress of gas lighting in Dartmouth, he said it was about 19 years since the town was placarded by Messrs. Holcombe and Co., the proprietors of the then works, announcing that they would no longer be able to supply gas at the then existing price—viz., 8s. 6d. per 1000, and £3 10s. each for the public lamps for eight months in the year. A new company was then projected, and after a successful canvass of the town, was set afloat. He was asked to become honorary treasurer, which post he accepted, and from that emanated his connexion with the company. The result was that an entire new set of works was erected on the site of the old ones. Gas was lit for the first time on the 14th of August, 1858, at a reduction in the price from 8s. 6d. to 5s. 10d. per 1000, and public lamps at £3 5s. per lamp for nine months, instead of £3 10s. for eight months. Taking a view of the history of the company, he thought the consumers had not much to complain of; the public had been gainers, and the investors had no reason to be dissatisfied. The secretary of the company, in highly complimentary terms, then proposed the health of the chairman, which was most cordially responded to. The healths of the secretary, himself, and of the directors were heartily received, and the evening was spent in a very agreeable manner.

THE CORPORATION OF WORCESTER AND THE GAS COMPANY.

At the Meeting of the Town Council on Tuesday, the 20th inst., Alderman Woodward, according to notice, moved—"That the town-clerk be instructed to apply to the town-clerk or other authority of the various cities and boroughs in England, to ascertain if the gas-works are the property of the corporation; and, if so, whether the possession of them is profitable to the corporation or not. If profitable, to what extent, and how that profit is appropriated. If the acquisition of the gas-works is unprofitable, to what extent. And generally to ascertain if municipalities think their respective communities would be benefited by the supply of gas being in the hands of the corporation." In doing so, he said: The next business is the resolution I have given notice of in the *agenda*. I regret exceedingly that at such a late hour I should have to say what I have to state on a question of such immense importance. My motive in bringing it forward is to ascertain what our neighbours and other towns in the kingdom are doing with regard to having the supply of gas in the hands of the corporate body. I think you will agree with me it is very desirable we should know that; for I think it to be of the utmost importance that the supply of light, which is now one of the essentials of existence in cities and large towns, should, the same as water, be under the control of the governing body. I may say that late last night I received a statement, showing that at Stafford they have obtained compulsory powers to purchase the gas-works; that the purchase is completed, and I believe the works were handed over within the last week. I find also that in the little borough of Evesham they are doing precisely the same thing. At Hereford they have already done the same thing. A similar process is going on in all communities where they have an eye to the best interests of those they represent. I believe it is so in Droitwich and in Bristol. I see that in Huddersfield the profit made by the corporation during the past year was £3000. What did they do? They immediately reduced the price from 3s. 4d. to 3s. I cannot tell you what the illuminating power was; but I have no doubt that in Huddersfield, as in most of the northern towns, they have gas of a very high illuminating power, and very likely, therefore, 3s. would represent what we should have to pay 5s. for. I ask the council to adopt this resolution, if they agree with me that it is most important that the manufacture and sale of gas, which has very much to do with our streets and other public matters, should be in the hands of the corporation. I find, on referring to the report of Messrs. Carter and Carter, given, I think, in 1873, that they estimated that up to the year 1866 the gas company had appropriated, in extensions of works, mains, &c., £35,000, that ought to have been in the pockets of the ratepayers. I find that from 1866 to 1873 they added another sum of £15,000, making £50,000. If the same process has been going on from 1873 to 1877, there is another £10,000 to be added, making £60,000. If that £60,000 had been in the hands of the corporation, and expended on various improvements in the city, we should have been saved a large amount of discussion, and we should not have been squabbling this morning about repairing a house at a cost of £6 5s. Looking to these things, and feeling that it is to the best interest of the city that we should be in a position to see exactly what has been done, and what ought to be done, I have to move the resolution of which I have given notice.

Mr. Hughes: I beg to second the proposition. No doubt some members of the council are shareholders, and I hope, when the time comes for decision, they will really show that they are willing to do something for the benefit of the city which they always speak of being proud of.

Mr. Birbeck: It appears to me that the worthy alderman, like many others who have a hobby, seems to be determined to ride his hobby to death. I also think that probably, if it had been the worthy alderman's fortune to have been a considerable shareholder in the gas company, we should have heard nothing of this matter. I will call your attention to a paragraph which appeared in a Sheffield paper of Wednesday last:—"In the course of a very long and heated discussion in the Sheffield Town Council on Wednesday some extraordinary revelations were elicited. In 1870 the corporation went to Parliament for the purchase of the gas and water-works, and soon after proceedings were taken, the water company obtained an injunction against them from using any of the funds of the ratepayers for that purpose. Some members of the corporation, however, gave the town-clerk a personal indemnity, under which expenses were incurred amounting to upwards of £7000. The corporation proceedings in Parliament were unsuccessful, and consequently the whole of the expenses fell upon the town-clerk. A voluntary rate to pay them off yielded only £2500, and the town-clerk now stated that he was out of pocket to the amount of £5600. With considerable emotion he stated that he had been sued for the expenses incurred by the corporation, that he had been put in the Bankruptcy Court for them, and that he had had to sell property in order to meet some of the claims." I sincerely trust, whatever the result of this discussion may be, we shall not see our town-clerk in the unfortunate position the town-clerk of Sheffield was. I have made some inquiries relative to the number of gas-works in the hands of local boards, and those belonging to companies. If the town-clerk should be called upon, as I trust he will not be, to make all these elaborate inquiries, I think he will find the result to be this; the governing bodies in boroughs have in their possession gas-works to the number of 200, of which 100 are paying their way. As to the others, it is best to say nothing about them. The number of gas-works that are in the hands of companies is no less than 1100, of which nine-tenths are paying a very good dividend. I trust the council will seriously consider the question, and not get into a position out of which we may not be able to see our way. Since the gas-works at Birmingham have been in the hands of the corporation, the price of gas has been raised. We are here having first-rate gas, of which none of us can complain, at a very moderate price. I trust nothing will be done in this council which will cause us to get out of what Alderman Woodward would have you believe is a frying-pan into the fire.

Mr. Noake: I am not without misgivings that the gas business would be managed worse by the corporation than by the company. At the same time, I shall support Alderman Woodward's resolution, because I feel it to be most necessary that we should have every information we can get from towns where the plan has been tried. We find that all the surrounding districts, even the smaller towns, are now coming to the system of purchasing the gas-works. At Droitwich they are buying the works. At Evesham I see the Local Government Board are willing to permit the Town Council to buy the works and extend the repayment of the debt over 50 years, making it comparatively easy. I shall vote for the resolution merely for the purpose of getting as much information as we can on the subject.

Mr. E. Lechmere Pugh: I think there can be no possible objection to the motion. When we have obtained the information it will be time to discuss the matter, for we shall then thoroughly understand what we are talking about.

Mr. Fisher: I have great pleasure in referring to what Alderman Woodward said at the last council meeting—that he had no desire to interfere with the gas company unduly, but that he wished them to profit by their works as far as they legally should do. I think we are all of the same feeling on that matter; but we have a duty to perform to the whole city. This question has been raised, certain statements have been made, and unless we ascertain how matters stand a little further than we have already done I think we shall be wrong. We commit ourselves to nothing by this motion.

Alderman Josiah Stallard (chairman of the gas company): I do not at all object to these inquiries being made, especially if they embrace some further information. There will be no great addition to the cost when we are going to the expense of applying to a very large number of towns, and I think the information I refer to will be very useful. It may be within your recollection that, a short time ago, we printed a statement as to the working of the water-works, and there it was shown that for several years the city had suffered a serious loss. My object in rising is simply to suggest to Mr. Woodward that he should add to the resolution after the word "gas," the words, "and water," so that we may know in what towns the corporations possess the gas and water-works, and whether they are going on prosperously or not, and thus get all possible information necessary to guide the council. I feel, for one, that there has been a great many—I will not say wilful—misrepresentations made in regard to this subject, and that it is very essential that not only the council, but the city, should know precisely what is the result of the working of the water-works, and what would probably be the result of the working of the gas-works, assuming the council had the control of them. If Mr. Woodward will accept my suggestion, and have inquiry made as to water-works as well as gas-works, so that the two subjects may be thoroughly elucidated, I shall be perfectly content. I think we shall get a great deal of information that will be very valuable to us and to the ratepayers.

Mr. Lovsey: I think Mr. Woodward's motion does not go far enough. Wherever there is a profit, it would be very valuable information to us to know at what price per 1000 feet the gas is sold, and the illuminating power.

The Town-Clerk: I have been noting these things. I have a very vivid recollection that the illuminating power in Plymouth is something like 20 candles, and from a paragraph which has been going the round of the papers this week, we find that, although they are so much more distant from the coal-fields than we are, they are now supplying gas at 2s. 2d. per 1000 feet. I think it very important to ascertain what the cost is there, and especially with regard to the public lamps. I agree with Mr. Pugh, that we can all vote for this motion with a little addition, and that the time to discuss the matter will be when the information is obtained. As to the question of water, I do not know that it is at all necessary to mix up the two questions, because I apprehend that where the corporate bodies have both gas and water supply under their control, the accounts of the two things are kept separate and distinct. It does not follow that if there is a loss on the water-works, there cannot be a gain on the gas-works. We are perfectly satisfied as to our water-works, and we want to be satisfied as to the gas.

Alderman Woodward: I am quite willing to adopt the suggestion of Mr. Lovsey, that we should get to know the illuminating power and also the price. That, I think, is a very important element. I endeavoured to make my resolution so mild and so gentle that I thought there would not be the smallest possible opposition in the council. With regard to what Alderman Stallard has said, I certainly do not think that very many of you will agree it is a good thing to mix gas and water. We have the water question settled, and if there is any loss to the ratepayers, it arises from the fact that our water-works were constructed as much for sanitary purposes as for anything else. Therefore, if we do not get a large return, the city, generally, reaps a very great benefit from it. I should like it to be borne in mind—I have stated it over and over again—that according to the Acts of Parliament under which the present company are established, they can only divide 10 per cent., no matter how large a sum they may realize as profit. It may be that this question will have to be carried further, and that ultimately we shall have to apply to Parliament for compulsory powers; but I hope and trust the wisdom of the board of directors, and the wisdom and foresight of the shareholders of the gas company, will see that it is better to settle it amicably among ourselves than to go for compulsory powers, as has been done in other places. I think we could settle it on such just and equitable terms as would be to the benefit of all parties. I would give the shareholders of the gas company bonds for £25,000, bearing interest at 10 per cent., guaranteed by the city. I would allow them to take that very delicate and very well manipulated fund called the reserve-fund. I do not wish to go into these matters, because, as Mr. Birbeck says, it has been my hobby. So long as I am a member of the council, I shall endeavour to discharge my duties honestly and faithfully. I have no other hobby to ride than that which I think is for the best interests of my fellow-citizens.

The Town-Clerk suggested that after the word "ascertain," in the last sentence of the resolution, should be inserted the words, "the particulars as to the supply of gas by municipalities and."

Alderman Woodward accepted this addition, and the motion was then carried without any dissentient.

Mr. Lovsey: Would you refer this matter to any committee, or appoint one specially? It is a very large matter, and will require some consideration before it is presented to the council.

Alderman Woodward then moved—"That the replies received to the foregoing communication be referred to the Watch and Lighting Committee to consider and report thereon."

Mr. Partington seconded the motion, which was agreed to.

THE GAS QUESTION AT WIGAN.

Report of Mr. T. Newbigging, C.E.

To the Committee of Gas Consumers of the Borough of Wigan.

Gentlemen,—The instructions which you placed in my hands when I undertook, at your request, to make the present inquiry, are as follows:—

"*Wigan, Feb.* 23, 1877.

"Sir,—The Gas Consumers Committee request us to state that they wish you to understand your instructions to be as comprehensive as possible, dealing with the whole question of the general management of the gas-works, the manufacture of the gas, and the distribution of the same.

"We venture, also, to offer you the following suggestions, which have occurred to us. "Yours faithfully,

"Alfred Birkett, } Hon. Secs.
"Joseph John Bellis, }

"To Thomas Newbigging, Esq.

"1. Inquire as to the quality of the coal used, and also that used from September to December, 1876.

"2. As to the time the charges are allowed to remain in the retorts, and the condition of the coal when placed therein.

"3. Examine the manner in which the exhausters are worked.

"4. Examine the present state of the condensers, scrubbers, and purifiers.

"5. Is the substance used in the purifiers suitable for retaining in it the impurities of the gas, and giving to the consumers a pure gas?

"6. What is the kind of burner used in testing the illuminating power of the gas? and is it according to the Act of Parliament?

"7. Can the gas be kept at so uniform a standard as reported by the borough analyst?

"8. Will Wigan consumers have an undue pressure by reason of the

gas supplied to the out-townships—viz., Ince, Pemberton, Upholland, and Standish — having to be forced through the mains used in the borough?

"9. Are the governors at the works of any special practical use for the out-townships only?

"10. Is the increase in the gas bills for the past quarter, varying from 20 to 100 per cent., satisfactorily accounted for in the manager's report?

"11. Taking into consideration the quality of the coal used, is the coke offered to the public at a reasonable price?

"12. Are the proposed alterations, as suggested at the meeting of the Gas Committee on Thursday, the 15th inst., such as you could recommend?"

You also drew my attention to a resolution passed at a meeting of the Town Council, on the 7th ult., as follows:—

"It is resolved that, in compliance with the request of the ratepayers, permission be given for any gas engineer whom they may appoint, to inspect the gas-works, and the mode of working the same, at any time, and that Mr. Hawkins be instructed to give him every facility for so doing."

Pursuant to these instructions, I have spent some time at Wigan, and having given careful attention to the various matters referred to me, I beg to report as follows:—

The gas-works, taken as a whole, have a dilapidated appearance, the only portions which may be excepted from this general description being those which have undergone renovation at the hands of the present manager during the past 12 months.

The retorts are in settings of seven in a bed, and are contained in two stacks of benches, being 18 feet and 20 feet throughs respectively. They are 98 in number, making a total of 196 mouthpieces. The charges are of six hours duration, and each mouthpiece is capable of producing, on an average, about 5000 cubic feet, or, on the whole, close upon 1 million cubic feet of gas per diem of 24 hours. All these retorts were in action during the depth of the winter.

The coal used is the Wigan four-foot and Arley Yard—both of fair quality for gas and coke producing purposes—mixed with 11 per cent. of Wigan cannel of good quality. These, the manager informs me, have been in use throughout the winter, mixed during the earlier part of the season with a portion of Hucknall cannel left in stock from a previous contract.

There is no covered storeage room for coal at present; but it is intended to erect a roofed shed 84 feet long by 60 feet wide. This will hold about 1200 to 1500 tons of material, equal to a fortnight's stock, calculating on the maximum use; and this, in my opinion, is ample, taking the locality into consideration. The coal is deposited in the open yard, in the vicinity of the retort-house (except such small portion as can be placed within the retort-house itself), and exposed to the deteriorating influences of the weather. This, during the past extraordinarily wet season, has been particularly objectionable.

The coke in stock, which is of fair quality, reaches the large quantity of 6000 tons. It has been allowed to accumulate, I understand, in anticipation of better prices being obtained.

It is a mistaken policy to store coke to any large extent at any gas-works, and especially in a place like Wigan, in the midst of a rich coal-field, if customers can be got to purchase at almost any price. The cost of storeage is heavy, and the deterioration of the material immense. Probably not more than 70 per cent. of the present stock will ever be sold, the rest will be converted into breeze and dust. The present retail price is 8s. 4d. per ton (5d. per cwt.), and one or two large lots of 1000 tons have recently been sold at 5s. and 6s. per ton, loaded into railway waggons.

An unused gasholder-tank, 70 feet diameter and 21 feet deep, less 6 feet for the brick arches that have been erected to cover it in, has been utilized by the present manager for the storeage of the tar and ammoniacal water. This was a sensible arrangement, as the previous storeage room for these products was altogether insufficient, and the occasion of loss of revenue to the undertaking by reason of the almost constant overflowing of the well in the winter season.

The contract price of these residuals is 32s. per ton for the tar, and for the ammoniacal water 2s. per ton for each degree of Twaddel. These are the ruling market prices at the present time.

From the retorts the gas passes through the hydraulic main to the condensers, of which there are two, of the ordinary vertical description; 36 pipes in each, 12 inches in diameter, and 18 feet long. These are just about 50 per cent. too small for the work they have to do; and they are in a most unsatisfactory condition, patched and hooped in numberless places, and leaking in several.

There is only one scrubber, 10 feet in diameter and 30 feet high. This is 66 per cent. too small in capacity, and 50 per cent. deficient in regard to height. The water-distributing arrangements are also imperfect, and altogether the vessel is practically useless in its present condition.

There are two new Jones's rotary exhausters, driven each by its own engine, with governor and bye-pass, each of capacity sufficient to pass 50,000 cubic feet of gas per hour. One of these was in action at the time of my visit, and was being worked as near as possible at a level gauge. Taking into account the leaky condition of the condensing apparatus, it is advisable to work the exhauster so as to allow of a slight back pressure, in order to avoid the risk of drawing air.

It is an unfounded suspicion, but one very widely entertained amongst consumers, that one of the purposes for which the exhauster is used is to force air into the gasholder along with the gas. This is an entire misapprehension; no manager in his senses would attempt any such thing. The small quantity of 3 per cent. of air mixed with the gas would destroy its illuminating power to the extent of 18 per cent. The object of the exhauster is to relieve the retorts of the pressure that would otherwise be thrown back upon them by the weight of the holders, and the passage of the gas through the dense materials contained in the purifying apparatus; and its effect is to increase the illuminating power of the gas, by preventing the deposition of the rich carbon on the sides of the hot retorts.

There are two steam-boilers, having their steam-pipes feeding the engines coupled together, with valves inserted; the intention being to make either the one or the other available whilst its fellow is being cleaned. The valves, however, are in so leaky a state that it is impossible to clean one without stopping both; and as it is indispensable that the exhausters be kept going during three-fourths of the year at least, both boilers have to be constantly at work. The result is that no cleansing or examination has been possible for months, and it is simply hazardous working the boilers under present circumstances. I am unable to certify as to their condition for the reasons given; but, taken singly, they are too small for supplying steam to drive the exhausters, and do the other necessary pumping that is required.

The purifiers are four in number, 20 feet square, and 5 feet deep each. These were originally constructed with a division-plate or mid-feather across their middle, the gas rising up one side and passing down the other. The present manager wisely altered this arrangement, by cutting holes in the division-plates and raising the gas outlet to the top of the vessels. This, by doubling the area for the passage of the gas, not only reduced the back-pressure, but rendered the purification more effective and economical. Notwithstanding this, however, the purifying area is 50 per cent. too small for present requirements, without taking into account the great increase in the consumption that may be expected to take place.

The bulk of the purifying material used is oxide of iron, but a layer of lime is placed at the bottom of the purifiers for the purpose of arresting a portion of the carbonic acid, and another layer of muriate of iron to take up the ammonia which ought previously to have been eliminated by the scrubbers. Perfect purification of the gas cannot be attained by the process followed, but Wigan is in no worse position than most other places in this respect. After the gas leaves the scrubbers, there are three principal impurities remaining, which it is desirable to eliminate. These are sulphuretted hydrogen, carbonic acid, and bisulphide of carbon. To accomplish satisfactorily the perfect purification (practically speaking) of the gas from these impurities, three sets of purifiers are required, and the use of lime has to be largely resorted to. The *modus operandi* is as follows:—The first and second sets are charged with lime, the third with oxide of iron. On the gas from the scrubber entering the first set, the lime is acted on by the carbonic acid and sulphuretted hydrogen simultaneously, leaving the bisulphide of carbon, at the beginning of the process, to pass unabsorbed. After they have worked for some time, the sulphuretted hydrogen in the first set is gradually expelled by the incoming carbonic acid, for which the lime has a stronger affinity. The second set is now being fouled with sulphuretted hydrogen, the lime being wholly or in part changed in character, having become sulphide of calcium, in which state it has an affinity for, and consequently arrests, the bisulphide of carbon and other sulphocarbon compounds; whilst the unabsorbed sulphuretted hydrogen passes on to be finally taken up by the oxide of iron, with which the final set of purifiers is charged.

It is only in the Metropolis where the legal restrictions are such as virtually to compel the adoption of the process described, and there the nuisance arising from the use of lime is found to be so intolerable as to induce the Chartered Company to introduce a Bill during the present session of Parliament, giving a relaxation of the restrictions in this respect.

In using oxide of iron only, the sulphuretted hydrogen is entirely removed; but the two other impurities, carbonic acid and bisulphide of carbon, are left untouched. It is generally admitted, however, that the small amount of sulphur thus left in the gas is not injurious to health in any degree, and the principal effect the carbonic acid has is to deteriorate the illuminating power. But if this is maintained at the parliamentary standard, there can be no ground for objection on that score.

The station-meters, of which there are two, capable of passing 35,000 cubic feet and 50,000 cubic feet per hour respectively, are sufficient in size, but they are placed as inconveniently as possible, back to back, in separate rooms, the floors of which are some distance below the general level of the yard.

There are two gasholders. One of them is telescopic, averaging 97 feet diameter, and 40 feet deep; the other, single, 98 feet diameter, and 29 feet deep; their combined capacity being half a million cubic feet, supposing them to be in proper order. The single holder, however, is in but very indifferent condition, its capacity being curtailed by the bottom row of sheets being corroded into holes. The actual working capacity is, therefore, somewhat under the amount stated.

It is a well-known rule, that, for economical working, the storeage capacity of the holders should be at least equal to the maximum daily make. This, at the Wigan Gas-Works, is 950,000 cubic feet, the largest quantity sent out on one day being 1,250,000 cubic feet. The storeage capacity is, therefore, barely one-half what it ought to be, and this deficient storeage is particularly objectionable in large manufacturing towns, where the great proportion of the night's consumption, amounting in places like Wigan to nearly one-half of the whole, is given out during the hours from five to half-past seven o'clock in the evening, in the depth of winter.

Looking at the apparatus on the works generally, I can sincerely commiserate the manager on the difficulties he has had to contend against, and the anxious and harassing time he must have experienced during the past season. I am satisfied that it has only been by the exercise of devoted attention and great experience and skill that the difficulties of the position have been surmounted.

The governors are three in number, and arranged by means of valves to control the pressure, each in its own particular district. Provision is also made by which, should the necessity arise, all the three districts can be supplied through any one or two of the governors. The arrangement is as follows:—

No. 1 is on the main supplying the higher parts of the town, and Standish.
No. 2, ditto, Chapel Lane, Wallgate, Poolstock, New Town, Pemberton, and Upholland.
No. 3, ditto, passing through Darlington Street to Higher and Lower Ince, Aspull, and Haigh.

There can be no question that, for some considerable time prior to the recent enlargements, the arterial mains leading from the works, through the town, towards the outlying districts, were utterly inadequate for the purposes of supply, according to the Act (Wigan Improvement Act, 1874, section 79 [3]), which prescribes that "the pressure shall be such as to balance from midnight to sunset a column of water not less than six-tenths of an inch in height, and from sunset to midnight a column of water not less than eight-tenths of an inch in height at the main," under a penalty, according to section 36 of the Gas-Works Clauses Act, 1871, not exceeding £20, if it should be proved to the satisfaction of two justices that on any day the gas supplied by the undertakers was under less than the prescribed pressure.

The following is an enumeration of the principal enlargements that have been made in the mains during 1876:—

Two 18-inch mains out of the north end of the works, in lieu of one 15-inch.
One 18-inch to top of King Street, in lieu of 6-inch.
One 16-inch to top of Market Place, in lieu of 6-inch.
One 8-inch in Market Place, in lieu of 3-inch.
One 8-inch from Douglass Bank House, near the Infirmary, to Boar's Head, in lieu of 4-inch.
One 6-inch from Boar's Head to Standish, in lieu of 3-inch.
One 10-inch in Pemberton District to Robin Lane end, in lieu of 6-inch.
One 10-inch to Lamberhead Green, in lieu of 6-inch.

In addition to the above, several serious defects in the mains have been discovered and remedied. For instance, in three different parts of the district—viz., at Standish, Ince, and Amberswood—mains 3 and 4 inches in diameter were found to have been severed (one of such being clearly an intentional severance), a piece of the pipe several feet in length removed, the connexion between the severed pipes being made with a length of wrought-iron tube of ¾-inch and 1-inch diameter thrust into both ends, and cemented round. On one of these connexions in the township of Standish a 1-inch stop-cock was fixed on the inserted wrought-iron pipe, ostensibly for the purpose of admitting of the gas being shut off from the consumers beyond, when a better than the normal supply of gas was

required on occasions of festivity at Standish Hall. In the very centre of Wigan also, in the market place, there was an interval of 95 yards between the 6-inch mains, filled up with a 3-inch.

Notwithstanding the enlargements and improvements mentioned, and the maintenance of a high initial pressure, the supply to some portions of the outskirts is barely up to the requirements of the Act. Proof of this statement is furnished by the fact that, although many of the borough consumers accounts have increased in amount from 20 to 100 per cent., the average increase over the entire gas district is barely 13 per cent., the actual figures being:

Gas sold, quarter ending December, 1875 . . .	47,777,500	cubic feet.
" " " " 1876 . . .	53,967,200	" "
Increase	6,189,700	cubic feet,

being at the rate of 12·95 per cent.

It is extremely desirable, both in the interests of the consumers and the gas undertaking, that before the next lighting season such further enlargements of the mains may be made, particularly of those supplying the districts of Higher and Lower Ince, Aspull, and Haigh, as shall admit of the supply being maintained at a materially reduced initial pressure. It is only by such means that the heavy leakage, amounting to 23·8 per cent. for the twelve months ending December last, can be reduced to any satisfactory extent.

The bulk of the old service-pipes are of half-inch wrought iron, a size that should not be placed in the ground under any circumstances whatsoever. The fixing of these costs as much as pipes of greater diameter, and their extensive use entails a high initial pressure throughout the district. I saw a large number on the gas-works premises that have recently been taken up and replaced by pipes of wider bore.

The meters in use amongst the consumers are of the wet description, and these, in my opinion, are the best to be employed. I understand they are all, or nearly all, stamped in accordance with the Sales of Gas Act. No consumer is justified in harbouring for any length of time a suspicion in regard to the correctness of his meter's registration, as he can take the necessary steps to have it tested by the official inspector, of course paying the expenses incurred, in the event of its being found correct.

The record of testings by the borough analyst between the dates of December 2nd and February 26th last, show a remarkable uniformity in the illuminating power of the gas, the highest being 18·46 candles on January 22nd, and the lowest 17·57 candles on February 12th, or a difference of only ·89 of a candle.

I tested the illuminating power of the gas twice during my visits, and found it the first time 19·40 candles, and the second time 20·42 candles value. The proportion of cannel employed must have been increased during the time of my visit to give this high illuminating power. I regret that this should have been so, as there was no necessity for it.

The instrument used in testing is that known as the Letheby photometer, and the burner is a 15-hole Argand, with a 7-inch chimney. The experimental meter and other appliances are of Sugg's best make, and all in accordance with the Act of Parliament—viz., sections 47 and 48 of the Wigan Gas Act, 1861, which, by section 79 of the Wigan Improvement Act, 1874, is made to apply to the Corporation Gas-Works.

Wigan Gas Act, 1861.

Section 47.—All the gas supplied by the company shall be of such quality as to produce from an Argand burner, having 15 holes and a 7-inch chimney, and consuming 5 cubic feet of gas per hour, a light equal in intensity to the light produced by 18 sperm candles of six in the pound, each burning 120 grains per hour.

Section 48.—The company shall, within 12 months after the passing of this Act, cause to be erected, in some part of the works, an experimental meter, fit for testing the gas manufactured by the company, furnished with an Argand 15-hole burner and a 7-inch chimney, or other approved burner and chimney capable of consuming 5 cubic feet of gas per hour, and other necessary apparatus, so situated or arranged as to test the illuminating power of all the gas supplied to the consumers.

Wigan Improvement Act, 1874.

Section 79.—(4.) The prescribed number of candles, and the prescribed burner, shall be such as are respectively prescribed by section 47 of the Wigan Gas Act, 1861.

(5.) With reference to section 28, the prescribed time and testing-place shall be such as are prescribed by section 48 of the Wigan Gas Act, 1861.

The gas was free from sulphuretted hydrogen. Ammonia was present in considerable quantity, as might naturally be expected from the deficiencies of the condensing and scrubbing arrangements.

The more regular and efficient inspection of the meters during the past twelve months has, doubtless, had its effect in increasing the amount of the consumers bills. It must be mentioned, also, as assisting to explain the cause of the heavier gas bills, that the past season has been an unusually dark one, and Wigan is not singular in its complaint of increased accounts. But the increase is principally due to the recent enlargement of the mains, and the high initial pressure, reaching 30-10ths, that was maintained during the earlier lighting hours.

It is here, in my opinion, wherein consists the true ground of the consumers complaints, and justifies the agitation that assumed such formidable proportions. Some seasonable advice ought to have been tendered to the consumers, as to the effect the high pressure would have, and the remedies necessary to be applied.

The circumstances in which the manager was placed were onerous and difficult. On taking the post, twelve months ago, he found a wide outlying district in the hands of the corporation, which they had undertaken and were bound to supply with gas. The evidence which has been laid before me, and the result of the pressure-tests which I have personally taken over the district, convinces me that the resources at the manager's command when he arrived were altogether inadequate.

In addition to their own borough, the following local board districts are supplied with gas by the corporation:—Pemberton, Orrell, Upholland, Standish, Aspull, and Ince. From most of these bitter complaints were received of the inefficiency of the supply, and threats of "other measures to be taken," beyond mere complaints, were made, if an improvement was not speedily effected. Even in Wigan itself, complaints of deficient pressure were numerous. This is only what might be expected from the small size of the mains, and the numerous services of half-inch wrought pipe that were in use.

During the summer and autumn of last year the extensive enlargements of the mains were made, both through the town and in portions of the out-districts. This, with the continued high pressure, partially remedied the deficiencies in the outskirts; but the effect in the town itself has been the enormous increase that has taken place in many of the accounts of the consumers, due to their having consumed a much larger quantity of gas under the altered conditions of supply.

It would appear, however, that there is considerable irregularity in the rate of increase of many of the accounts of consumers in the immediate locality of the enlarged mains, and this circumstance is very naturally remarked and commented on, and my opinion asked as to the cause. The reason of these differences is as easily explained as the other, but perhaps the explanation may not be so readily understood or accepted. In my opinion (and I speak from experience) they arise in this way. It will be found almost without exception, that wherever the service-pipes have been renewed, an increased account has been the result. On the other hand, where no material increase in the consumption has taken place, the old service-pipes have remained either wholly or partially undisturbed. The majority of these are of small bore, and much corroded, and although the augmented pressure would force an increased quantity of gas through them equally with the newer pipes, yet, by reason of the augmented pressure, the accumulated dirt in the interior would be driven forward till arrested by an angle or internal roughness, and, in consequence, the clear passage of the gas would be still further reduced. It may be set down as an absolute fact, that where the service-pipe has been renewed, there has been an increased consumption and a heavier account. In many instances this will be so where no renewal has taken place; but in such cases the supply-pipe is of ample size, and less corroded.

The idea that systematic errors have arisen in the taking of the meter-states may be dismissed as untenable. An occasional mistake may be made, it is true, but these are quite exceptional. It is just as easy to read the dials of a meter as the dial of a clock, and any person, with ordinary eyesight and intelligence, can accomplish the one as readily as the other. With very small meters, having only two dials, it is possible to make a mistake of 10,000 cubic feet, owing to the fingers of the dials having both made a complete revolution during the intervals of inspection, but in such cases the gas authorities are usually the sufferers, and if it occurred on the other side, any consumer making an objection to his account on that score would easily be able to satisfy the manager of the validity of his complaint.

The Gas Committee might save themselves and the manager some trouble, and allay the suspicions of many of the consumers, by circulating one of the useful pamphlets that are published, giving instructions, not only for reading the meter, but for burning the gas to the best advantage. I venture to give the names of some of these that occur to me at the moment:—

"How must I Manage the Gas?" by J. O. N. Rutter.
"The Gas Consumer's Manual," by E. S. Cathels.
"A Guide to Gas Lighting," by Alfred H. Wood.

These are all excellent, and are written by men who have made the subject a life's study.

Instructions for reading the meter-dials might also be printed at the head of a card left with each consumer, and on which the states at the end of each quarter could be recorded by the meter inspector.

The old iron flat-flame burner, I observe, is very generally in use, the result being the destruction of the light to the extent of 30 to 50 per cent. As an example of the general ignorance that prevails in regard to burners amongst the consumers, I may state that one of them, whose account was in excess of previous quarters, expressed to me his astonishment at the circumstance, and the small illuminating power of the gas, stating that he had now in use the identical burners that were inserted 15 years ago. Important improvements have been effected in the construction of burners within the period named, but, even when using the best kind, their frequent renewal is both desirable and necessary for securing the proper development of the light.

There are many excellent burners in the market, constructed on true principles, to be purchased at prices within the means of every gas consumer. Of these, Sugg's, Brönner's, and Bray's may be specially recommended. But whatever the kind of burner adopted, the pressure of the gas must be controlled and regulated to obtain the maximum of light. This cannot be accomplished satisfactorily, by checking either the taps on the fittings, or the stopcock at the meter, because the pressure in the mains is continually varying according to the consumption that is going on. There is a small instrument called a governor or regulator that does this effectually. It may be fixed on the pipe leading from the meter outlet. It is automatic in its action, and when weighted to afford the required pressure for the burners in use, it will continue to give a practically uniform supply, however much the pressure in the mains may vary, or whether the whole or only a portion of the burners being supplied through it, may be alight at one time. Wherever the regulator is adopted in the neighbourhood of the heavy pressure, a considerable saving will be the result.

There is a further great advantage attending the use of the regulator. It developes the illuminating power of the gas by ensuring its consumption at a low pressure. It is a clearly established fact that the lower the pressure (provided there is just sufficient) at which gas can be burnt, the better the light. The principal cause of the complaints as to the illuminating power of the Wigan gas throughout the borough is due to the heavy pressure that has had to be maintained by reason of the exigencies of the supply. Instead of being advantageously consumed, the gas has been forced through the burners into the atmosphere, the carbon (the light-giving medium) being oxidized by the excess of air drawn into the flame by the heavy pressure, with the usual unsatisfactory results as regards illumination.

I concur generally in the necessity for the extensions proposed by the manager to be made during the present year. With his estimate of the cost of the same, however, I do not agree; most of the items are, in my opinion, considerably under the mark. The proposed new tank and holder of the size stated, will cost from £2500 to £3000 more than the sum put down for them.

The present prices of the gas supplied by the corporation are—

Inside the mile radius, under 150,000 cubic feet per annum, 3s. 10d. per 1000; outside the mile radius, 4s. 11d., less 10 per cent. discount if the amount is paid within one calendar month from the date of delivery of the bill. Inside the mile radius, 150,000 cubic feet and upwards per annum, 3s. 10d. per 1000; outside the mile radius, 4s. 11d., less 20 per cent. discount if the amount is paid within one calendar month from the date of the delivery of the bill.

Notwithstanding that the capital of the concern is somewhat high, amounting to nearly £800 per million cubic feet of gas produced per annum, with the necessity facing the Gas Committee of still further adding to its amount, I am satisfied that if the judicious management now being pursued is continued, the corporation will soon find themselves in a position to make a handsome reduction in the price per 1000 cubic feet.

From my observations during the investigation, I have come to the conclusion that the gas enterprise has not had fair play during past years of its existence. Without going beyond the present boundary, I feel assured that there is a wide field for gas extension in the district.

I beg to bear my testimony to the facilities for making the inquiry that have been rendered to me by the chairman and members of the Gas Committee; by Mr. Hawkins, the manager of the gas-works; and by Mr. Betley, the borough analyst. I have also to thank the secretaries and members of the committee of gas consumers for the willing assistance they afforded to me in my endeavours to arrive at the facts; and I testify to their frequently-expressed desire that the investigation should be made without prejudice, and reported on in the like spirit.

I am, gentlemen, your obedient servant,

5, Norfolk Street, Manchester, March 16, 1877. THOS. NEWBIGGING.

ON THE VOLUMETRIC DETERMINATION OF SULPHUR AND AMMONIA IN ILLUMINATING GAS, WITH A DESCRIPTION OF THE APPARATUS EMPLOYED.

By H. E. Sadler and B. Silliman, of New Haven, Conn.

(*Concluded from page* 424.)

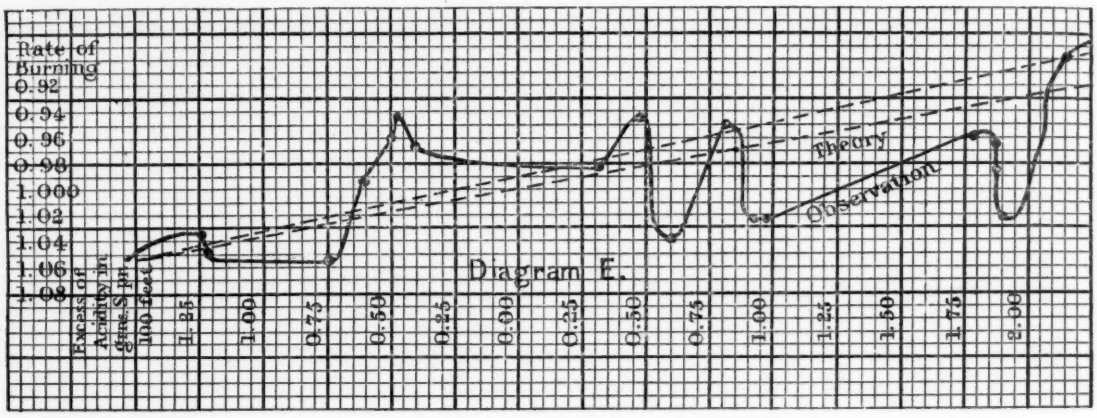
The Formation of Nitrous Acid and other Sources of Error.

In endeavouring further to reduce or eliminate this variation, the drip from the condensation-tube was carefully tested for other acids and bases. Besides the soda and sulphuric acid, nitrous acid, probably mixed with nitric, was detected by silver nitrate, and also on setting free the nitrogen acids with sulphuric by the coloration tests, ferrous sulphate, brucia, &c. No other acids could be found—carbonic, of course, excepted. The absence of sulphurous acid or a soluble sulphite was a surprise. It was demonstrated by precipitating duplicate samples, oxidizing but one of them. The resulting precipitates did not differ sensibly in weight. This fact was further confirmed by adding 10 cubic centimètres of a carefully titrated solution of potassium sulphite to successive equal portions of the drip. On titrating back with standard iodine solution and starch paste, it was found that 5·65 cubic centimètres of the sulphite in each solution had been oxidized. Of the bases a trace of ammonia alone was found. The drip in experiment No. 12 was submitted to Nessler's test, and showed 9-10ths of a grain of ammonia per 100 feet, equal to 84-100ths. of a grain of sulphur. The nitrogen acids were not determined, as no means for the estimation of so small quantities presented itself, except the somewhat difficult combustion process. It seemed impossible* that more than 100th of a grain of ammonia could be supplied by the 700 feet of air admitted by the apparatus for the combustion of 100 feet of gas, and it followed that the remainder must be produced in the burning. There was no other source for the nitrogen acid.

We are brought here face to face with a curious phenomenon. Nitrogen, forming simultaneously, under the same conditions, an acid and a basic radical with the oxygen and hydrogen directly or indirectly supplied by the air and gas respectively.

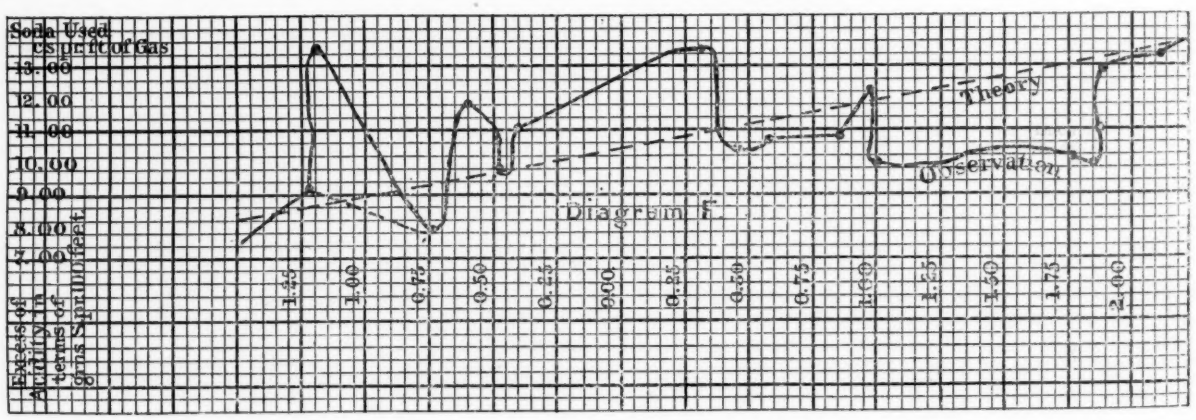
This fact has been before noted and more clearly proved.† Two theories present themselves in this connexion to account for the variations noted in the above table between the sulphur and the total free acids produced by the combustion. The first is that where the gas is passing rapidly and the flame is near the smoking point, the nitrogen will find an abundance of hydrogen from the gas and a scanty supply of oxygen. The tendency will then be to form ammonia in excess of nitrous acid. When, on the contrary, the gas is burned slowly and, the supply of air being the same, a surfeit of oxygen awaits the scanty hydrogen, acid will be more freely formed than ammonia. The excess of total acidity will then be a function of the relative supply of gas and air, and column VII. will follow column IX., which gives the rate.

How far our experiments sustain this view will be seen from diagram E:



The second theory plants itself upon the hypothesis of the dual nature of nitrogen gas, one atom of each molecule broken up in nitrification taking to itself hydrogen and the other oxygen. In this case an excess of acid or base from the nitrogen is impossible, the product of nitrification being uniformly ammonium nitrite, a salt. This substance, however, is very unstable, falling readily back to water and nitrogen, and yielding easily to an acid, ammonia, to a base, nitrous acid. Thus, this body, in passing through the condensing-tube, would surrender its acid to the soda, in amount somewhat proportionate to the quantity of free soda in the tube, while the ammonia, but slightly absorbed by the alkaline solution, would pass off at the escape. Column VII. would then accord in some sort with column VIII., which gives the relative proportion of soda and gas used in each experiment.

Diagram F shows the variations:



To pronounce upon the accuracy or sufficiency of either proposition without further experiments made with especial reference to them would be premature. Probably outside of certain limits which we may call the normal working, both the rate and the alkali used have their influence on the result, as will appear more clearly by comparing the two curves given above with the curve of their average as shown in diagram G:

For the rest, the perturbations must be charged to the inaccuracy of the test as worked, of which there are several sources which, small in themselves, may yet be considerable in the aggregate. First, we assume that, at the end of an experiment, the condensing-tube contains the same quantities of alkali and of sulphur as at the beginning. The difference, when compared with the total quantity, must be small, but a difference there may be. Second, the alkali pipette attached to the apparatus, the acid pipette and burette, and the alkali burette, must be strictly accurate; at least they should accord with themselves and each other. The former of these conditions was not in our apparatus entirely fulfilled. Third, the opportunity for error is considerable in judging the change of colour with cochineal, especially when the determinations are made on different days, and cannot be compared with each other. And, lastly, the "personal error" cannot be entirely disregarded.

Other Products of the Combustion.

Aside from the acids and bases, no substance among the products of combustion was positively identified. Potassium iodide paper, moistened with starch liquor, and suspended above the marbles in the condensing-tube, immediately showed the presence of an oxidant, probably hydrogen dioxide or ozone, since nitrous acid was hardly possible after passing this alkaline solution. Blue litmus paper, however, was here reddened, but rapidly bleached. The reddening was probably due to the carbon dioxide.

A portion of the drip from each of the last eight experiments was preserved in tightly-stoppered bottles, and at the conclusion of the experiments tested for oxidants with 1-20th normal sodic hyposulphite and iodine solutions. No oxidation of hyposulphite took place in alkaline solution. Upon acidifying with hydrochloric acid, from one to two cubic centimètres were found to be oxidized. After adding excess of hyposulphite, and allowing the solutions to stand—Nos. 12, 13, and 14 over night, and the rest for one hour—the following results were obtained. Since no oxidation took place in the alkaline solution, it was inferred that nitrous acid was the oxidant, and not hydrogen dioxide or ozone, and the results are accordingly expressed in grains of nitrogen oxidized in the combustion of 100 feet of gas:—

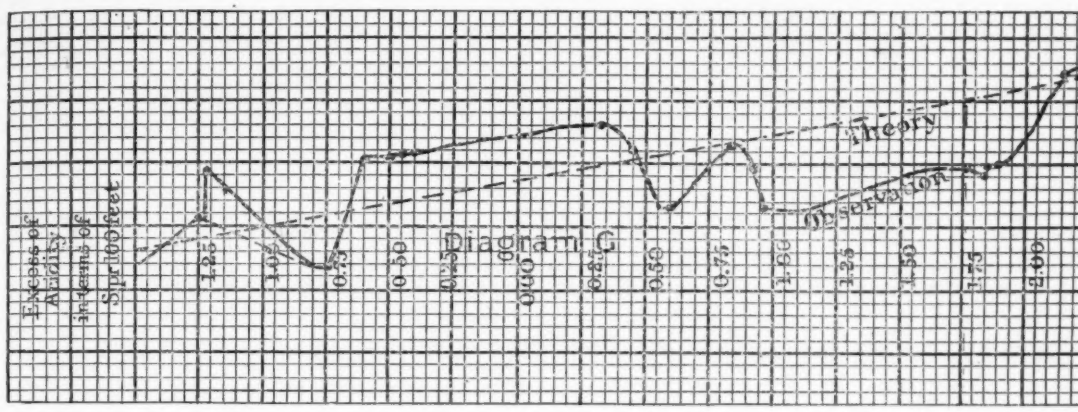
Table H.

	Grains N.			
No. 12.—0·988	equal in saturating power to		0·86	grain of sulphur.
No. 13.—0·739	"	"	0·65	"
No. 14.—0·706	"	"	0·62	"
No. 15.—0·415	"	"	0·36	"
No. 16.—0·411	"	"	0·36	"
No. 17.—0·354	"	"	0·31	"
No. 18.—0·292	"	"	0·26	"
No. 19.—0·244	"	"	0·21	"

These results seem to indicate so unquestionably that much the greater part of the oxidation was due to the atmospheric air absorbed by the liquid that it is barely worth while to recall in this connexion the Nessler

* See Johnson's "How Crops Feed," p. 55, and especially Viele's determinations Pelouze and Fremy, I., 320.

† Shaeffer *American Journal of Science*, Nov., 1863. T. Sterry Hunt, "Chemical and Geological Essays." Appendix p 446. Shönbein, London and Edinburgh. *Philosophical Magazine*, June, 1862, p. 466.



determination of the ammonia in No. 12, 9-10ths of a grain per 100 feet, equal in saturating power to 0·84 grain of sulphur. The above table shows nitrous acid in No. 12 equal to 0·86 grain of sulphur.

Further Suggestions.

The possibility of avoiding the complication arising from the arrest of varying quantities of nitrogen acids, and of further simplifying the working of the test by substituting pure water for standard alkali in the condensing-tube, is suggested by a consideration of the fact that sulphuric oxide possesses so great affinity for water, and that, when once in solution, especially if the proportion of water is large, only slight traces of acid vapours are given off, even under the most favouring circumstances.

It may be true that, in the combustion of sulphur, sulphurous and not sulphuric oxide is the body immediately produced; but it is rendered probable by several experiments, most of which have been detailed above, that, travelling in company with the powerful oxidants produced by the combustion of hydrocarbons in air, no considerable quantity of sulphur would enter the combustion-tube without being completely oxidized—a view which receives confirmation from the important experiments of M. Vérigo, communicated to the *Académie des Sciences* by M. Berthelot, reported in the *Comptes Rendus* for April 24, 1876.* If this inference prove unfounded, we have still a safeguard in the comparatively ready solubility of sulphurous oxide in water, with which the products of combustion are very thoroughly scrubbed in the condensing-tube; and, as a last resource, the addition to the scrubbing water of a small quantity of standard solution of borax, which is a great solvent for sulphurous oxide.

While still under the impression that sulphurous acid was the chief substance to be met with, some experiments which depended for success upon the power of water to arrest sulphuric oxide, as suggested above, gave the following results:—

TABLE I.

No. 1.—14·93	grains	S.	per 100	feet.
No. 2.—31·52	,,	,,	100	,,
No. 3.—17·51	,,	,,	100	,,
No. 4.—10·51	,,	,,	100	,,
No. 5.—10·48	,,	,,	100	,,
No. 6.—18·60	,,	,,	100	,,
No. 7.—18·43	,,	,,	100	,,
No. 7.—15·34	,,	,,	100	,, (Letheby.)

The products of combustion were bubbled through water, and bromine added continuously by an automatic arrangement to oxidize the sulphurous acid. The exhauster, a Richard's pump, used to draw the gases through the water was insufficient in capacity and uncertain in its action, and, accordingly, only a small quantity of gas, from 2-10ths to 4-10ths of a foot, could be burned for each determination. A volumetric estimation of the sulphuric acid was then obtained by expelling the free bromine with heat, and the hydrobromic acid by digestion with silver oxide, or better with silver carbonate. When this had settled, an aliquot portion of the supernatant liquor was withdrawn for titration, but as it was found to contain dissolved silver salts sufficient to obscure the reaction between hæmatoxylin or cochineal and an alkali, these were removed by precipitation with hydrogen sulphide, the excess of which was in turn expelled by boiling. The remaining free acid was titrated with standard alkali. In dealing with such small quantities the probable error was, of course, very large, and it was thought useless to make comparative experiments with the Letheby test until the apparatus should be put in condition to burn a larger quantity of gas for each determination. Before so amending, the whole process was abandoned in favour of the alkali test, and we have accordingly but one comparative experiment, No. 7. The general results afford some indication, however, of what might, under more favourable conditions, be accomplished with water as a scrubbing liquor.

Résumé.

In reviewing what has been accomplished, an advance in two directions seems possible:

1. An apparatus has been devised for bringing gases into contact with a liquid, which is an improvement on bubbling them through the liquid contained in a Woolfe bottle in three respects. The necessity for an exhauster or blower is avoided, the gas is completely broken up, affording a more intimate contact, and the proportion of the two may be so regulated as not to flood the products. 2. The gas engineer is provided in this apparatus with a complete indicator of the working of all his purifying processes except the removal of the tar.

It is continuous. There is no instant of the day or night when the quantity of ammonia and sulphur passing into the holders or street-mains is not being accurately measured.

It is ever ready, and if the condensers and scrubbers allow an abnormal quantity of ammonia to pass, or the purifying-boxes become over-worked, and there escape traces of hydrogen sulphide, which every engineer now intends to remove, the test papers give immediate notice, and the amount of damage done can be quickly determined.

It is complete. The presence and quantity of ammonia, and of hydrogen sulphide and the other sulphur compounds, are indicated, and the possible presence of carbon dioxide; for, on account of the well-known power of that body to decompose moist calcium sulphide, setting hydrogen sulphide free, no noticeable quantity of carbon dioxide can pass the purifiers without the previous escape of hydrogen sulphide.

It is rapid. Ten minutes is ample time to determine both the ammonia and sulphur.

It is inexpensive. Fifteen dollars will provide all the glassware for the apparatus. The breakage is small, and the chemicals cost comparatively nothing.

Finally, it is simple in theory and practice. To work it successfully requires no knowledge of chemical theories, and the needful manipulations can be easily acquired by a little care and attention to a few simple directions.

* Since this paper was read, our attention has been called to the fact that Mr. C. Heisch F.C.S., had already observed the absence of sulphurous acid (London JOURNAL OF GAS LIGHTING, &c., Dec. 29, 1874, p. 856), and in the October number of the *American Chemist* are reported some experiments of Mr. W. C. Young, F.C.S., leading to the same conclusion.—*Authors.*

THE CHEMISTRY OF GAS MANUFACTURE.

By A. VERNON HARCOURT, Esq., F.R.S.,
One of the Metropolitan Gas Referees.

[A course of Four Cantor Lectures delivered at the Society of Arts, London.]

FIRST LECTURE.—MONDAY, MARCH 5.

I propose, this evening, to give you, in the first place, a short account of the formation and chemical nature of coal, and afterwards to offer a general view of the subject, which I shall deal with more in detail in succeeding lectures—namely, the result of the application of heat to coal, especially in connexion with the manufacture of coal gas.

Coal was formed from the air, by a process, the beginning of which we are all familiar with, through watching the growth of vegetation.

The air consists, as you know, chiefly of oxygen and nitrogen, so that in 100 volumes there are about 78·4 volumes of nitrogen, and 20·6 volumes of oxygen; but it contains also small quantities of two other substances which for vegetation are much more important—namely, water and carbonic acid. Of water it contains ordinarily about 1 per cent., and of carbonic acid no more than ·04 per cent. Nevertheless, it is on the presence of these substances in the atmosphere that the growth of vegetation depends.

The plants which grew at the time when our main supplies of coal were formed differed greatly from those which exist on the earth at the present time; so much so that very few of them can now be referred by botanists to any existing genera. I owe to the kindness of Professor Tennant some diagrams which are now upon the walls, giving examples of a reconstruction of those plants. The remnants or impress of them are chiefly found not on the coal, but in the shale which underlies the coal, and which has preserved the record more perfectly than the more alterable, softer matter of the coal itself.

Although the actual genera are different from those which now exist, yet we may compare these plants with various existing genera. For example, this *Lepidodendron*, of which a portion is drawn here, appears to be a plant of the same kind as the small club moss with which we are familiar, but on a gigantic scale.

Again, there are representatives of the tree ferns and of the coniferns, of which I have here some drawings. Then there is what seems to have been a large tree, which is called *Sigillaria*, because of the marks, as if impressed by a seal, existing on its stem; and what was formerly supposed to be a separate plant, but has now been proved to be only the root on which this trunk grew. These roots or stools have been preserved more abundantly than the trunks, so that often where the trunk seems to have entirely disappeared, the roots remain, and as they were supposed to be different, they received the distinct name of *Sigmaria*.

Then, again, another variety of plant, which seems to have abounded in the coal measures, corresponds to the *Mares Tails*, which now grow in marshy places or equiseta. It is, however, uncertain whether the predominance of these varieties in the fossils of the coal measures depends on their greater abundance amongst the vegetation of that period, or rather upon the fact that they have better resisted the influences producing change to which this deposited vegetation has been subjected. Some interesting experiments were made several years ago by Professor Lindley on the powers which different plants possess of resisting decomposition, and he found that out of 177 kinds of plants which he left for two or three years under water, there were only 56 which had not wholly disappeared, and among these were the representatives of those varieties which are found in abundance in the coal measures, rendering it thus probable that the preservation of the forms of these plants may be due rather to their being able to resist the protracted action of water than to their greater abundance.

What may have been the nature and appearance of the forests or jungles which overspread a large portion of the earth's surface, for countless generations of vegetable life, must remain but dimly known. In coal itself the very traces of organic structure are almost wholly obliterated. All that we can say confidently is, that coal consists of the mineralized vegetation of a former period.

As to the way in which it has been accumulated, there were amongst geologists, some years ago, two rival theories. One view is that coal consists of the remnants of plants falling where they had stood, and that by a process of gradual decay, such as is now converting the heather of our moors into peat, these great masses of vegetable matter were accumulated, and converted into a more or less homogeneous mass. The interstratification of these deposits with sandstone, limestone, and shale is supposed to have come to pass in the following manner:—After these plants had grown and died for many generations, the portion of the earth where they grew was flooded, the vegetation was destroyed, and, during the time that it was submerged, mineral matters were deposited where the plants had grown. This submergence, also, we must suppose

to have continued for a very long time; then the sea, or more often, it would seem, the fresh water, retiring, plants were again sown, and vegetation again throve for a long period; and thus the cycle of changes repeated itself. Probably this is the true account of the formation, at any rate of the greater part, of the coal that we have. By this alternating deposition of vegetable and mineral matters, we have the state of things which an examination of the earth's crust reveals, and which is well illustrated by the section of the coal measures of the Forest of Dean, which Mr. Warington Smith has lent me. Represented by this grey band is the new clay, which seems to have been the soil in which the plants of the coal measures grew. Then there is an accumulation of coal, the vegetable matter stored up; afterwards there was a period of inundation, and of deposition of mineral matter, which went on accumulating for a long time. The thickness of these strata represents in some sort the length of the periods of time which intervened between each change. The breadth of the black line represents, relatively to the rate of deposition of the organic matter, the length of time during which the forest flourished. Then followed the deposit over it of sand, now compacted to sandstone, for a length of time, through a long alternation of periods here recorded in strata and so on. No doubt the tax on the imagination of receiving a view of this kind is very great, especially if we figure to ourselves how long a period is required for the storeage of the amount of vegetable matter which a single coal seam represents. The greater part, no doubt, of the carbon of these plants passed away into the air and disappeared, as the plants disappeared in Professor Lindley's experiments. Then we have to suppose those changes happening far inland, and simultaneously over a great portion of the earth's surface.

The other hypothesis to which I referred is, that these deposits have been formed chiefly from vegetable matters carried down by rivers. There are examples of such accumulations at the mouths of the Mississippi, and other large rivers, which best illustrate this hypothesis where there are great floods, and quantities of vegetable matter borne down and deposited in the delta of the rivers. What seems likely is, that both these causes have been in operation. But the extent and continuity, and even thickness of the seams of coal, and the fact that trees are found standing upright with their roots still bedded in the under clay, make it probable that the former hypothesis truly represents the principal mode in which coal has been accumulated. But wherever the storeage of vegetable matter and the deposition of great masses of other materials upon it, so that it has become deeply buried in the earth's crust, and subjected to a high temperature and great pressure—wherever this has happened, there has occurred the process by which coal is formed.

Then, besides the deposition of the vegetable matter, we have also to account for the change which it has undergone. The two principal causes which have concurred in producing this change are pressure and a high temperature. We know that now, as we descend through the earth's crust, the temperature rises at the rate of about 1° Fahr. for every 60 feet that we descend. It is to be remembered also, that of the coal which we can now reach, or which comes within the 4000 feet of depth fixed by the Royal Commission as the greatest depth from which we should ever be likely to succeed in winning coal, much, at any rate, has been at another time at a greater depth beneath the earth's surface than we now find it, and that afterwards, by disturbances in the crust of the earth, it has been carried up to its present level.

Bischof has gone into the question of the nature of the changes by which woody fibre may have been converted into coal, and pointed out that there are various chemical changes by which this may have been effected. The abstraction of water, carbonic acid, and carburetted hydrogen, or of any two of these, produces an effect which may generally be described as a removal of a portion of the oxygen and hydrogen from the woody fibre—the carbon remaining behind in larger proportion. That, at any rate, is the nature of the principal difference between wood and coal, that oxygen and hydrogen exist in larger proportion in wood, and that the change by which coal has been produced has consisted in one way or the other in their more or less complete abstraction.

Another change, and one, perhaps, harder to understand, has gone on at the same time. Not only does coal differ from wood in the proportion of its organic constituents, but it differs from it in a remarkable way in its mineral constituents. The ash of coal is a very different thing from the ash of wood. Moreover, the ash of coal is almost the same as the ash of shale, and we must therefore suppose further that the coal, or the material of the coal has been exposed to the action of water carrying mineral matters, either in solution or in suspension, for a sufficient length of time for its own mineral ingredients to be washed out, and those which were borne in solution or suspension by the water to have been substituted for them.

There, on the wall, is a diagram, showing the position of the coal measures in the series of strata down from the surface of the earth, which may serve to illustrate the great depth where all these strata are superimposed of the formation in which the coal lies.

I pass next to the changes which are produced in coal by the application of heat. Such changes occurred independently of man's agency, and at a period long before man appeared upon the earth. We know that in several parts of the earth it has been observed that inflammable gases issue from the ground. At Chat-Moss, in Lancashire, it was observed long ago—that by simply making a hole in the ground, placing a pipe in the hole, and applying a light, a flame could be maintained for a long time; and actually such gas has been applied to the lighting of buildings. Then, again, not only does nature make gas, but in making gas nature makes coke. Anthracite is natural coke—it is coal which has been exposed to a high temperature, and thus has undergone the same changes which we produce in coal by exposing it to artificial heat. When coal is heated, the change it undergoes depends upon the temperature to which it is heated, or the rate at which it is heated. Probably the meaning of this is, not that coal, speaking of it as one substance, undergoes different changes, according as it is heated quickly or slowly, but rather—which, I think, is the true explanation of the matter—that, when it is heated quickly, the products which are first produced by heating it are exposed to the high temperature before they can escape. Probably the effect of heating coal quickly to a high temperature might be perfectly imitated by subjecting the products of its decomposition at a low temperature subsequently to a high temperature. This may be difficult to effect on a manufacturing scale, or may have no economical advantage. I believe something of the kind has been tried, but the true account of the matter is probably this—not that the same substances undergo chemical changes different according as they are exposed at once to a bright red heat, or gradually and gently heated; but that, when coal is treated in the way in which it is treated in a gas-retort, and is suddenly exposed to this strong heat, the substances which would be simply distilled from it, if it were first heated gently, come into contact with strongly heated surfaces, and thus undergo a further change. The difference in the result is, that coal which is gradually heated gives off a much larger proportion of liquid, and a much smaller proportion of gaseous products, than coal which is suddenly heated strongly.

When the process of heating coal for economical purposes was first introduced, I believe the object in view was not the production of gas, but of the liquid and solid products. In 1781, Lord Dundonald took out a patent for the distillation of coal, his object being to produce *brown oil*, as it was called, naphtha, ammonia, and coke; but the gas was let go. Works for this purpose were in operation for nearly 50 years at Muirkirk, in Ayrshire. A curious circumstance in connexion with these works is, that among the coal which was thus treated was found some cannel, which was thought to be unsuitable and thrown away.

I have here a miniature gas-works, lent by my friend Mr. Fison, which is now in action, and shows every step in the manufacture of coal gas, the heating of coal in the retorts, condensation of tar, ammoniacal liquor, washing, purifying, storeage, and distribution. There are also on the walls a set of diagrams, lent me by Dr. Frankland, illustrating the same operation.

The solid residue, when coal has been heated in the retort, is the well-known substance called coke. The same substance, or very nearly the same substance, is also produced in coking-ovens for use in locomotives, and for other purposes. It contains some three-fourths of the total weight of the coal which is distilled; and when the coal employed is a caking coal—that is, a coal which, when it is heated, is sufficiently bituminous to partially fuse, and so aggregate itself together—the coke remains behind in a solid piece, such as I have here. In many respects coke is superior to coal as a fuel. It has over coal the same advantage, for many purposes, that anthracite or steam coal has over other coal. You know that for use on board ship, and wherever a clean fire is required, the steam coal or smokeless coal is greatly preferred to ordinary bituminous coal. We do not commonly use coke for fires in our sitting-rooms; but I believe that this depends upon the form of grates which we are accustomed to use. A better form of grate has recently been advocated, under the name of Slow Combustion Grates, in which the air is not admitted to the fire from below, but only in the front. The effect of admitting air through an open grating beneath the fire, is to cause the coal to burn quickly away. If air enters from the front, combustion takes place, and each coal glows on the side towards the room. The grate should have a high and wide front, but be shallow from front to back, and have flat bars set edgewise, or rather far apart. The open space above the top bar should be no more than sufficient for putting on coals. In a grate of this kind, as I can testify from my own experience, coke can be burnt with the help of a little coal, just as well as coal, and with a better heating effect. I cannot but think that the consequence of the reform in our grates, which I hope to see, will be that this fuel will be largely substituted in domestic use for coal, to the advantage both of the householder and of the gas manufacturer. At times like the present, when the price of coal is lower than it has been, and the winter is mild, the quantity of coke which accumulates is very large, and the value of it to the maker is often very much below its real value. The reason we now use the bright or blazing coal in our fires is, that the air being admitted through the bars below, the chief part of the combustion goes on there, radiating heat only upon the hearthstone, and the upper part of the fire, which is what we look upon, would be dull, unless we used a coal yielding a great deal of gas, in order that we may have a blaze at the upper surface, and see something bright.

The gases which pass out from the retort consist partly of what are termed permanent gases, and partly of what are distinguished as vapours; that is, of gases which, under other circumstances, would not be gases but liquids.

This distinction between gases and vapours is more misleading than it is serviceable. When we speak of a substance which is perfectly gaseous as a vapour, we recall by that word a circumstance which is generally quite irrelevant—namely, that under other conditions, if the temperature and pressure were different, this substance would be a liquid. Most probably the same is true of every gas; we know it to be true of all gases except six. It is as though we restricted the word "liquid" to permanent liquids like alcohol, and had another word for liquids which could be frozen. However, at the ordinary temperature a great deal that is gaseous at the high temperature of the gas-retort becomes liquid, and so is collected separately. I have on the wall two long tables, giving the names and the chemical formulæ of the great variety of substances which have been found among the products of the destructive distillation of coal. You will see that in one table all the substances, whose names and formulæ are given, consist of combinations of two only of the elements of coal—hydrogen heading the list, and all the other substances being combinations of it with carbon. Those which stand first on the list—hydrogen and marsh gas—are both permanent gases, which have never been liquefied. The others are substances which exist in the gas, and which are also partially condensed with the tar. They are grouped here according to their chemical classification, not according to their volatility. Those which come lower down are liquids. Paraffin is the name generally given to a solid substance that is obtained from coal, and it is given also by chemists to both liquid and gaseous substances which have the same general formula, $C_n H_{2n+2}$. Acetylene, again, is a gaseous hydrocarbon; then come some of the principal of the liquid bodies that are produced. Naphthalene is sometimes gaseous and sometimes, unfortunately, solid. It is liable to be deposited, and to obstruct gas-pipes at a distance from the works. Anthracene—a substance of which I shall have more to say presently—is also a solid substance. Then there are others into which oxygen, nitrogen, and sulphur enter, in combination with carbon, or hydrogen, or both.

This other table gives the results of a number of analyses of the different kinds of coal. The varieties of coal range, shading one into the other, from that containing the largest proportion of carbon—namely, anthracite—to highly bituminous coals, passing on into cannel coal, and into a substance about which there has been a dispute whether it is coal or not. This is Boghead cannel. This still richer substance of which Mr. Evans has kindly sent me a specimen—Boghead shale, as it has been called, from its resemblance to Boghead cannel—comes from Australia. You will see, from the specimens I have here, how extremely these substances differ in appearance from each other; indeed, different samples of cannel coal differ very much from one another, some being quite devoid of lustre, and some being brilliant like anthracite. The more bituminous coals yield a larger proportion of liquid products. Coals are called bituminous, not because they contain bitumen—for this substance cannot be extracted from them—but because they yield it when they are heated. As to the actual substances existing in coal, very little is known, because the actual constituents of coal are extremely insoluble, and chemists have not succeeded, by the application of solvents, in extracting directly (by processes which will produce no change in the coal) substances which they can isolate and examine. Thus it happens that our knowledge is almost entirely of the substances producible from coal by heat, and not of the substances—equally definite, no doubt—which already exist in it.

I shall have to speak in a subsequent lecture of the substances which enter into ammoniacal liquor, as it is called, but will pass now to the other of the two liquid products of the destructive distillation—namely, tar; and consider, in the time which remains, the nature of some of the products which have been obtained from it.

Tar is a mixture, in varying proportions, of a great number of different substances. When it is heated it is divided into more and less volatile parts. There distils from it first some water—indeed, a principal difficulty with the tar distiller is to get rid of the water with which the tar is

mechanically mixed. After that there comes over a substance which the tar distiller calls "liquid naphtha," which is subjected to a subsequent distillation. Next there comes over a substance of higher boiling point, of a consistency which is almost solid—a buttery substance which is called "creasote;" and, lastly, there comes over a substance which is at first more fluid, but afterwards nearly solidifies, called "anthracene oil," because anthracene is obtained from it. That which first distils over has nothing characteristic in it sappearance, being a limpid, colourless liquid. In these bottles are the products of the subsequent distillation.

The crude naphtha is first acted upon by soda. It is brought into contact with something like one-third of its volume of a strong solution of soda. It contains, besides benzol and other similar hydrocarbons, a quantity of another important substance—namely, carbolic acid. This unites with the soda, and the two together form a heavy liquor, on the top of which the lighter naphtha floats. The liquor is drawn off and mixed with sulphuric acid; it separates, as it cools, into two layers, the lower one consisting of a solution of sulphate of soda, and the upper one of the crude carbolic acid. The tar distiller carries the operation no further than to run away the sulphate of soda, of which he makes no further use, and to draw off the carbolic acid. The naphtha is next acted on with sulphuric acid, which combines with the organic bases substances containing nitrogen, as well as carbon and hydrogen, and the purified naphtha, now containing only hydrocarbons, is distilled. In this first distillation the greater part is collected together, and a small quantity remains behind, which is rejected or mixed again with the crude naphtha. It is then what chemists call "fractionally distilled"—that is to say, distilled in a gradual continuous operation; while the runnings of the still are collected separately. The receivers employed are carboys; the order in which they are filled is noted; and, subsequently, an examination of their contents is made, and the liquid products classified accordingly. The examination consists in determining the boiling point of the liquid. According as the manufacturer wishes to have a hydrocarbon of a higher or lower boiling point—which depends on the demand in the market—he mixes with the first portions distilled a larger or smaller proportion of the subsequent distillate, so as to have either a larger quantity of somewhat higher boiling point, or a smaller quantity of lower boiler point. These two are called respectively 90 per cent. benzol and 50 per cent. benzol—meaning a liquid which is judged, from its boiling point, to contain 90 or 50 per cent. of pure benzol.

Benzol is a hydrocarbon, of which the formula is $C_6 H_6$, and it is associated with other substances—namely, toluol, xylol, cumol, and cymol—substances which are homologous with benzol. These substances form a series proceeding in arithmetical progression by a difference of one atom of the carbon and two atoms of hydrogen, the first having the formula $C_6 H_6$, the next $C_7 H_8$, the next $C_8 H_{10}$, and so on. They are all mixed together in the naphtha, and they are, to some extent, separated from one another, in the fractional distillation, by the tar distiller. The purest benzol which is ever collected by the manufacturer contains some admixture of the other substances; but I have been lent, by Mr. John Williams, some samples of these different substances in a pure condition. Here are benzol, toluol, and xylol. Their appearance is absolutely similar; all are mobile colourless liquids; but we should find, if we were to place them in a flask with a thermometer, and heat them until they distilled freely, and observed the temperature, it would be in the three cases, 84°, 114°, 126°.

The actual distillates collected at the tar distillery consist of mixtures of these substances boiling at temperatures which differ according as the hydrocarbons of lower or higher boiling-point predominate. I have here some samples of the commercial products, which I obtained to-day, through the kindness of Messrs. Blott, from their distillery.

The sample next in volatility to benzol is called "solvent naphtha," the purpose for which it is employed being to dissolve india-rubber.

After a time, as the temperature rises, the liquid which comes over is found to be of too high a specific gravity, and unfitted for this purpose; it is called "burning naphtha," and is sold for burning in such lamps as are used sometimes to light stalls in the open air.

The second product of the original distillation—namely, "creasote"—is a pasty mass, which, on standing, divides itself, to some extent, into an oil and a solid, the solid being naphthalene. The chief use of this substance is for pickling timber; especially, I believe, railway sleepers. The pieces of wood are placed in cylinders from which air is exhausted, and then this substance is let in upon them, and forced into their pores by the atmospheric pressure. The wood is thus rendered more capable of resisting exposure to moisture and the attacks of insects than it otherwise would be.

Some portion of the oil which drains from the semi-solid mass is also used for making lamp-black. It burns with a very luminous, fuliginous flame, and the soot which is formed is collected and called lamp-black.

The third product is "anthracene oil." This divides itself into a liquid and a solid. It is poured upon frames carrying a filtering material, and the oil runs through, while the solid remains upon the filter, and is afterwards transferred to bags, where it is allowed to drain, and is then more completely dried and freed from the adhering oil by pressure.

Here are the three substances: the anthracene oil, which has a solid layer now settling, the "green oil"—so called from its colour—which is used for making grease, and thirdly anthracene.

I have here a pure specimen of the naphthalene, which is the solid substance accompanying the creasote; and also one of anthracene and of carbolic acid.

Besides the three distillates, the tar which is distilled leaves this solid substance called "pitch;" which also is applied to various purposes, the principal, I believe, now being that of making artificial fuel. It is mixed with breeze, and the pitch serves as a sort of cement to compact together other combustible substances, the whole forming a serviceable fuel. It is also used for making artificial asphalte, and in preparing a kind of felt.

It has also been supposed that, by further distillation of this substance, a further quantity of the valuable anthracene might be obtained; but I understand that, although the substance yielded by the destructive distillation of pitch greatly resembles anthracene, there is found to be some difference between them, which renders it not serviceable as anthracene is. The solid residue of the distillation of pitch is that which I have here—pitch coke—a very pure form of carbon, being almost free from ash, since it is formed by the destructive distillation of a substance which itself has been gaseous.

I have only a few words to add about the substances which are formed from these; but it is the less necessary to go at length into that part of the subject, though it is very interesting and important, because some seven or eight years ago it formed the subject of a course of lectures given here by Mr. Perkin, who is the principal among those who have developed this important and beautiful industry.

One substance directly produced by the destructive distillation of coal is "aniline;" but this is not produced in large quantity, and is not easily isolated. It was found first that from benzol, a substance of some use in perfumery, it may be obtained by the action of nitric acid, the product being called nitro-benzol; and it was also found that by the reduction of this substance—that is to say, the replacement of its oxygen by hydrogen—it was converted into aniline. This reduction was first effected by the action of sulphide of ammonium; but it was afterwards discovered that it was effected equally well, and more economically, by the action of acetic acid and iron. So that though coal and coal tar are the great sources of aniline, it is not obtained directly from them, although it exists there, but indirectly from the benzol, the benzol being first transformed by the action of a mixture of sulphuric and nitric acid into nitro-benzol, and then the nitro-benzol being further transformed by the action of reducing agents into aniline.

The first great discovery was that, by the action of oxidizing substances upon aniline, it was transformed into a black powder which was serviceable as a dye. By the action of sulphuric acid and bichromate of potash, aniline was transformed into a substance to which the name of "mauve" was given. Subsequently, in the hands of Mr. Perkin and others, this production of colouring matters from aniline received a very great development, and the consequence was the production of a number of beautiful pigments which are familiar to all of us, and of which I have here some specimens which Mr. Perkin has given me. There is, I think, no more striking or more beautiful result of the application of chemistry than that it should be possible, from such a substance as coal tar, to obtain substances at the very opposite end of the scale of mineral being, these beautiful coloured products.

There is one other point only which I would name. From the anthracene oil, anthracene is obtained; and from anthracene, by a series of processes which it would take me too far to go into, a substance which had long been used and known—viz., "alizarin." The investigation of madder, some 40 years ago, showed that the colouring matter consisted principally of alizarin and purpurin, of which alizarin was the more important. Then followed the great discovery that, by a succession of operations upon anthracene, it can be transformed into the same substance which is the colouring matter of the madder root; so that now actually the use of madder as a dye stuff is, I believe, almost disappearing: its place being taken by what can be produced to greater advantage economically—namely, the very same material produced from coal tar.

This is really the crowning triumph—at least, it is difficult to suppose it can ever be surpassed—viz., the application of chemistry to the arts; and with this I conclude the present lecture.

SOCIETY OF ENGINEERS.

Mr. Thomas Cargill, C.E., the President of the Society of Engineers, delivered his Inaugural Address at the meeting on the 5th ult. In the course of his remarks, referring to the progress of water, sewerage, gas, and other works, he said:

The supply of pure wholesome water to a town is one of the first considerations which should occupy the attention of the local sanitary authorities, and there is probably no professional duty which taxes more the skill and ability of the engineer, than the designing and construction of water-works. Unfortunately but very few of our large towns are provided with this indispensable requisite to the health of the inhabitants, and when our examination extends to our smaller towns and villages, the result is unsatisfactory in the extreme. Not one in a hundred has any water supply in the proper sense of the term, and the unfortunate people have to obtain whatever quantity they can, from wells but too frequently sunk in close contiguity to the cesspool. The facts which have been recounted by the various Royal Commissions appointed to inquire into this matter would not be credited, but for the unimpeachable evidence upon which they rest.

The opening of the Colne Valley Water-Works was successfully performed towards the latter end of last year. The cost was about £80,000, and the establishment of these works will be of the greatest benefit to the district.

Brighton was also provided with a further supply, by a method which I may briefly mention. The system adopted was to sink a number of shafts, and from them to drive a series of tunnels or headings into the chalk, and in this manner tap, or intercept, the water in its progress of downward infiltration to the sea.

During the ensuing year, it is intended to construct a new reservoir and other works at Bradford, at an estimated outlay of nearly a quarter of a million, and similar hydraulic works, upon a minor scale, will be actively commenced in many parts of the country.

Turning our attention to foreign countries, we find the authorities of Rio de Janeiro are prepared to expend over a million in supplying the town with water; and it is satisfactory to note that a very large order for pipes has been taken by a firm in this country. Recently an expenditure of £100,000 has been sanctioned for the construction of water-works at Simla. Irrigation works on a very extensive scale are projected on the Continent and in India.

In the latter country there are four principal descriptions of irrigation works: 1. Inundation canals. Examples of this kind are common in Sind and parts of the Punjaub. 2. Irrigation canals, whose waters are taken from rivers. These are principally in use in Northern India. 3. Canals in the deltaic portions of rivers. 4. Tank irrigation. It is only by multiplying these several systems of irrigation throughout a great portion of Hindostan that the severe famines which occur almost annually can be prevented.

The barrage of the Nile, the drainage of Lake Fucino, a work commenced 22 years ago and just completed, together with similar works in progress at Ferrara, are well worth the notice of engineers. At this last-mentioned place, the largest pumping-engines ever constructed are almost continually at work.

A very useful application of hydraulic power has been recently made at Kingston-upon-Hull. A system of main-pipes 6 inches in diameter is laid, for about a mile along the docks, and charged by pumping-engines with a pressure of 600 lbs. to the square inch. Any machinery, such as cranes, winches, or elevators, can be easily and economically worked, by simply connecting with the main-pipe. The power required is close at hand, and a person can pay for the amount he wants and no more. Many advantages result from this arrangement to the users of motive power. First cost is avoided in engines and plant. Less space is needed, and consequently less rent of premises incurred, and the risk from fire is also very much diminished.

It is with regret that I have to observe that we have not yet attained to a satisfactory solution of the sewage problem. There can be very little doubt that, so far as a principle is concerned, that of irrigation has given the only really reliable results. The number of different companies which have tried disinfecting and deodorizing processes, together with the manufacture of so-called artificial manures, is legion, and their numbers are equalled only by their failures. It has been calculated that one company alone squandered a million of money in the vain attempt to accomplish what, to all these processes, is a double impossibility—viz., the purification of the effluent water to the degree prescribed by the standard, and the manufacture of an artificial manure which shall pay the cost of its own production. Irrigation, and irrigation alone, by calling nature to its assistance, effects the double result by a single operation. Unquestionably, the great drawback to the more general adoption of the irrigation system, is the difficulty of procuring land suitable for the purpose. At home, we

are now tolerably familiar with the benefits which sewage irrigation confers upon every description of crop to which it is applied, and to the especial advantages which some particular crops derive from its application. The most recent successful example which has attended the adoption of the principle abroad is at Dantzig, a town, the drainage of which was carried out by one of our past presidents, Mr. Baldwin Latham. The crops which have been produced, both in variety, number, and quality, vie with those grown at the Lodge Farm, and on other well-known sewage farms in England.

The difficulty of obtaining land for irrigation purposes would be greatly lessened, if the powers conferred upon local boards were more vigorously supported and enforced by the higher authorities. That land still can be obtained is evident, if other instances were wanting, by the completion of the sewerage works at Oxford, where 350 acres have been acquired for the disposal and utilization of sewage by irrigation. Towns situated on the sea will doubtless continue to make use of that natural receptacle for their sewage, and it must be acknowledged that, in the matter of wasting so valuable a commodity, the Metropolis sets them an example on a gigantic scale.

The dilemma in which local boards sometimes find themselves, with regard to the disposal of the sewage of their towns, is well illustrated by the case of the sanitary authorities of Kingston. The sewage of this town originally flowed, as was the universal custom in all places similarly situated, into the nearest river, which in this instance was the Thames. The Board of Conservancy gave the Kingston Board notice to discontinue this practice, under penalty of an injunction being obtained against them after the lapse of a certain time. The answer of the Kingston authorities was: "You have closed the only outlet we have for the sewage and drainage of the town. What are we to do with it? Will you tell us where to put it?" The reply of the Conservators of the river was: "That is no business of ours. All we have to do is to see that you do not discharge it into the Thames." In instances of this kind, of which this is not a solitary example, it would sometimes be difficult to draw the line of demarcation between real inability to comply with the legal order, and a plea which might be simply *in contumaciam*, and intended as an excuse for shirking the whole subsequent responsibility and expenditure. In the Kingston case, whatever might have been the validity of the plea for non-compliance, the injunction was obtained, and the penalties actually incurred for neglect gradually reached the sum of £10,000. This modest total being arrived at, another respite was granted to the authorities, to enable them to extricate themselves from their embarrassment. A comprehensive scheme of drainage, which embraces several towns and districts in the valley of the Thames, has since been proposed, and is at present under consideration. It is not, however, very creditable to our sanitary legislation, that injunctions affecting the health of the population should be systematically disregarded, and penalties of a fabulous amount, so far as any chance of their recovery is concerned, incurred with equal carelessness and indifference. In order to ensure the due enforcement of our sanitary rules and regulations, the hands of both the administrative and executive departments require to be strengthened.

The erection of gas-works in towns of any pretensions to size, either at home or abroad, is now so usual a procedure that it fails to excite much notice. New gas-works, or extensions of existing ones, are being carried out in our own, as well as in nearly every foreign country which can lay claim to even partial civilization. The experiences of the last few years will clearly show, so far as the Metropolis is concerned, that the tendency to amalgamation, or centralization, is very much on the increase.

In 1869 there were 13 gas companies supplying London. In 1870 the number had diminished to 11, not by the extinction of the other two, but by the incorporation or absorption of them into the others. This number was again reduced in the following year to ten, subsequently to nine, and ultimately to six, which represents the number of separate and distinct companies supplying gas to the Metropolis. These are The Gaslight and Coke Company, the Phœnix, the London, the Commercial, the South Metropolitan, and the Surrey Consumers. The capital of these six companies in 1875 was over eight millions. One of the advantages attending amalgamation is, that a marked decrease has taken place in the loss of gas from leakage and other causes. The amount of loss has been reduced from 17½ per cent. to less than 7 per cent. But the chief benefit resulting from amalgamation is the diminished price at which the public can be supplied. Companies are empowered now to pay one-quarter per cent. over and above the maximum dividend of 10 per cent. for every penny they take off the price of their gas per 1000 feet. The company supplying the Metropolis with three-quarters of all its gas, now charge 3s. 6d. instead of 3s. 9d. per 1000, which is equivalent to three-quarters per cent. more dividend. The quantity of gas sold by the company who have made the authorized reduction amounts yearly to 14,000 million cubic feet, which, taking the difference of the two prices already mentioned, benefits the consumers to the extent of £175,000 per annum. It is an open question how far the principle of amalgamation will be carried. The companies situated respectively north and south of the river might amalgamate, or the incorporation of the whole say into one, might be accomplished. It is very possible that the principle of incorporation will be carried still farther, but the advisability of its reaching so extreme a point as unity is a fair matter for discussion.

ON THE ESTIMATION OF SULPHUR IN COAL GAS BY MEANS OF STANDARD SOLUTIONS OF ALKALI, Etc.

By W. C. Young, F.C.S., &c.,
City of London and Metropolitan Gas Examiner.

Rather more than two years since I was engaged in some experiments on the products of the combustion of coal gas, the results of the completion of which were published in No. 8 of the *Analyst*, and subsequently in the Journal of Gas Lighting.

The absorbents used were caustic soda and carbonate of soda. During the progress of the first part of these experiments, it occurred to me that by using solutions of these substances, of known strength, the sulphur could be estimated by subsequent titration with a standard acid.

The first experiment was made by drawing the products of the flame of a small Bunsen burner over a standard solution of soda contained in a Woolffe's bottle, partly filled with glass balls. The aspirator used was a Bunsen's filter-pump. The results were very satisfactory, but as I was unable in this way to burn the gas at a greater rate than ·25 cubic feet per hour, I endeavoured to adapt the Referees apparatus to this purpose. In this case, the standard solution of soda was dropped slowly on to the glass balls contained in the cylinder, from an ordinary separating funnel. No carbonate of ammonia was placed in the apparatus. The results obtained in this way were very concordant, but on the average gave 8 per cent. more sulphur than those obtained by the Referees apparatus upon the same gas.

The standard soda solution was made of such a strength that 100 septems was equal to 4 grains of sulphur.

One hundred septems of the standard acid was equal to one grain of sulphur.

One hundred septems of the standard soda was taken and diluted to 5 ounces with distilled water; this was placed in the separating-funnel, which was fixed by the side of the eduction-tube, in a cork fitted to the neck of the cylinder. The flow of the alkaline liquid was regulated to about one ounce per hour, and the gas burnt at the rate of one cubic foot per hour.

Four cubic feet of gas were burnt, and at the finish the apparatus was washed out, the drippings and washings made up to a known bulk with distilled water.

One-fourth of this liquor, after well mixing, was taken; to it was added 100 septems of the standard acid, and boiled in a long-necked flask for ten minutes, to expel all carbonic acid.

The excess of acid remaining was then ascertained by means of a standard soda solution, of the same strength as the acid, made by diluting one part of the original soda solution with three of distilled water. The number of septems used equal grains of sulphur in 100 cubic feet of gas.

The results obtained in this way were fairly comparable with those obtained by the first method; but, although I was enabled to burn the gas at a much faster rate, there still remained two difficulties in the way to its general adoption.

These were, first, that the stop-cock of the separating funnel had to be adjusted several times during the experiment, to obtain a constant flow of the soda solution; and, secondly, that the solution became eventually so diluted as to render it difficult to any but an experienced eye to determine the point of neutralization to within one or two septems.

In endeavouring to overcome the first objection, I experienced very great difficulty, but, in the end, devised an apparatus that succeeded admirably.

This consisted in a modification of the constant level apparatus used by Dr. Bischof, in his method of water analysis, and described in Sutton's "Handbook of Volumetric Analysis."

It is figured in the accompanying drawing, and consists of a flask, the neck of which is ground into a tube, narrowed towards the end to a fine bore, having at the side another small tube blown on at right angles, and again turned up, so as to be parallel with the neck of the flask. Into the vertical part of this tube is fitted a stopcock, and another is fitted in the narrow part of the other tube, about an inch below the juncture of the two. The flask may be of any capacity, the one I used held 30 ounces. I obtained the same results with this apparatus as with the last mentioned, but the second objection still remained. The method of using this apparatus is as follows:—The quantity of standard alkali to be used is placed in the flask, with enough distilled water to fill it, the cap with stopcocks placed firmly on, the whole inverted and fixed over a Referees cylinder, having a small funnel at the side of the eduction-tube. The lower stopcock is then opened full, and the liquid run through the funnel into the cylinder. The dropping soon ceases, after which the flow can be regulated as required by the upper stopcock, which admits the air, the rate at which it is started being maintained until the flask is almost empty. The apparatus can always be obtained of Mr. Cetti, of Brook Street, Holborn.

Subsequent experiments caused me to abandon the former methods, and resulted in the adoption of the following, which can be fitted up at most gas-testing places at very short notice. The apparatus consists of a double Referees apparatus, the end of the eduction-tube of one fitted to the lower neck of another cylinder.

Into the upper cylinder is slowly run the standard alkali to be used. By inserting the dripping-tube about three-quarters of an inch above the bottom of the interior, so as to form a reservoir, the whole of the standard alkali will be retained, and a constant surface of it presented to the acid vapours entering from the eduction-tube of the lower cylinder, under the trumpet-tube in which the gas is burnt.

In this way fully 95 per cent. of the moisture is condensed before the products of the combustion of the gas reach the alkali, which, being in a more concentrated state, admits of the gas being burnt at a much faster rate than in the other methods, and, what is more important, the point of neutralization in the subsequent titration may be determined with ease.

I prefer, with this apparatus, to use a weighed quantity of dry carbonate of soda, which is obtained sufficiently pure by calcining the commercial bicarbonate. I take about 40 grains, place it on the top of the glass balls in the upper cylinder, and moisten with about one ounce of distilled water. At the completion of the experiment I wash out the upper cylinder with hot water, add an equivalent quantity of standard sulphuric acid to the soda used, boil for ten minutes, then titrate back with standard alkali, one septem of which is equal to the 100th of a grain of sulphur. It is obvious that all excessive acidity must be due to the sulphur in the gas, and that if 10 cubic feet be burnt, each septem of standard alkali used is equal to 1-10th of a grain of sulphur in 100 cubic feet.

The liquor condensed in the lower cylinder is not used, but an addition of ·5 grain of sulphur per 100 cubic feet is made to the result—that being the average of a very large number of estimations I have made of the sulphur contained in this liquor, the quantity varying only from ·52 to ·48.

This method leaves nothing to be desired in point of accuracy or simplicity; those who are not experienced in the manufacture of standard solutions can always purchase them ready made, and, with a little careful practice, an intelligent workman can be entrusted with the estimation.

In most of my experiments I have burnt the gas at the rate of one cubic foot per hour, but I have obtained equally good results at twice that rate; indeed, I have no doubt that, by increasing the size and condensing power of the lower cylinder, the gas may be burnt at a much greater rate with the same result. I should add that the results with this, as with the other methods, were, on the average, 8 per cent. higher than those given by the Gas Referees apparatus.

I am now engaged in experiments, which I hope to publish shortly, by which I trust to be able to determine the sulphur by the difference in weight of the apparatus before and after its use.

ACCIDENT TO A GASHOLDER-TANK AT MIDDLESBROUGH.

Mr. Cail, engineer, of Newcastle-upon-Tyne, having received instructions from the Gas Committee of the Corporation of Middlesbrough, has prepared the following reports upon the collapse of the gasholder-tank, to which reference was made in the Journal of the 20th ult.:—

To the Chairman of the Gas Committee of the Borough of Middlesbrough.
Newcastle, March 7, 1877.

Sir,—In compliance with the request of Mr. Bainbridge, the town-clerk, on the 16th ult. I went to Middlesbrough, to inspect the new gasholder-tank which was in course of being formed in the Marsh. I made an examination of the work on the 17th, and also had an interview with the Gas Committee, who requested me to make myself acquainted with all I required, in order that I might make a report to them, what I thought best to be done under all the circumstances of the case, whether to form the gas-

holder-tank in the present site in the Marsh, or abandon it and buy land near the site of the proposed new workhouse at Linthorpe, and build the tank there. I was also requested to give any instructions necessary for retaining the work and buildings near in their then position; the worst thing to enable this to be done was the flow of water from drains which had been dislocated, and caused a large quantity of water to run into the interstices of the part which had subsided into the tank, and to this point Mr. Latham, your surveyor, gave his best and prompt attention, and is doing all in his power to renew the sewers in such a way as to remedy this evil, and he also assisted with the staple. Your gas manager, Mr. Booth, has also given me all the assistance in his power in getting a staple sunk down to a depth of 56 feet 6 inches below the surface, to ascertain the strata below the level of the bottom of the tank.

I was also instructed to make approximate estimates of the work in the two places named to me, being the site near Linthorpe, and in the Marsh where the present one has failed. I have given my best attention to the subject, and with this view I have carefully examined the strata down to 56 feet 6 inches, or 15 feet 6 inches below the bottom of the present tank, and I have come to the conclusion there is no great difficulty in building the tank, as a permanent and lasting work, at the site in the Marsh within the present one, by means which I will describe; and to be more easy to understand, I have made two small sketch plans, one being a half plan of two sizes of the proposed tank, and the other a plan of the cylinders for the foundation, which I propose to be sunk 14 feet in depth below the walls.

To carry out the work, I propose to lay down beams of timber across the tank, radiating to the centre, and to stay the present walls of the tank in their present position, and when this is done the water to be pumped out and all water stopped from flowing into the tank whenever practicable. Then to commence to build brick and cement cylinders of 6 feet diameter inside, and 7 feet 6 inches outside diameter, and about 4 feet high, having a tongue on one side and a groove on the other, thus forming a tie between each cylinder, which tongue and groove projecting 9 inches, makes a total of 8 feet 3 inches, or requiring about 52 cylinders of 134 feet in diameter, and 60 of 150 feet diameter, to form the ring or foundation for the concrete wall forming the tank. The cylinders to be built on a platform in a mould made the exact shape of the outside of the cylinder, and the bricks, being first thoroughly soaked in water, to be walled on edge and bedded in cement and clean sharp sand, with a thin joint of cement at the front inside, to prevent the grout coming out, to fill in pieces of shingle in the tail or back joint, and then to fill in each course with cement grout, so that each course will form a solid ring, and to continue this operation until each cylinder is built to about 4 feet high, so that these cylinders when put together will make the required depth. The bottom cylinder will have a sharp edge, the jointings above will have a bed of cement.

When the cement is sufficiently set, the cylinder to be lifted out of the mould off the platform to be ready for use, and others built in its place in the same manner. The site or place where the cylinders have to be sunk being levelled, it is not necessary that the ground should be at the level intended for the height of the cylinders to finish at, but may be higher, until a number of cylinders should be partially sunk; men would then go in to dig out the material and send it up, cleaning out below the cylinder all round, so that the cylinder would follow down; if the cylinders did not go down freely, they would have to be weighted with pig iron, and as one was sunk to the level of the ground, additional cylinders would be placed on the top until the required depth was obtained, when the bottom would be cleaned out, making a slight hollow (as will be described in the details), and then to fill in the interior of the cylinder to the top with concrete and blocks of sound slag, having been previously well soaked in water. When the cylinders are sunk to the intended depth, then cement grout is to be poured down the joints of the tongue and groove, and the ground cleaned round the top of the cylinders for a depth of 3 feet, and filled in to the line of the outside of the cylinders with concrete and blocks as before named.

On this to form a bed of concrete, 2 feet thick, the full width of the cylinders, and for 6 feet within the line of cylinders to form the rest for the gasholder, also laying a bed of concrete 6 or 8 feet wide inside the cylinders in the same manner as named above, thus forming an arch of from 20 to 22 feet in depth, to resist lateral strain. Upon this base to commence the wall of the tank, which I propose to commence 2 feet above the level of the present tank, and to build this wall 6 feet thick for a height of 8 feet, 5 feet thick for the next 8 feet, the next 7 feet 4 feet thick, the next 7 feet 3 feet 6 inches thick, and 4 feet at the top including the coping 3 feet thick, making the total height of the tank 34 feet from the hollow, 6 feet of which would be above the ground level. The whole of this wall to be built of concrete, having a considerable portion of blocks of solid slag put in (previously well soaked), and the liquid or plastic cement well beaten round them as the work proceeds.

I would also advise a dry well to be formed, which is not provided for at present (shown on plan), for the entrance and exit of pipes, so as not to interfere with the thickness, or make a break in the tank wall in any way, except at the bottom, where the pipes come through the wall by a small, arched opening. The pillar in the centre to be built in a similar manner, gravel or shingle mixed with it. All slag for concrete to be properly broken, and a sufficient quantity of slag, or concrete, gravel, or shingle mixed with it to form a proper matrix, or mattriss, to bed the larger stones solidly in it, that vacant spaces may be left. All concrete to be mixed by machinery to be approved of, unless by special authority, and only when the quantity to be used is small. The sloping part of the core in the interior to be cut and beaten into a solid body, any peat being removed, and clay substituted, and formed with a slope of 1½ to 1, to be laid with concrete 2 feet thick at the base and 1 foot at the top, and to continue 1 foot thick on the level part to the pillar in the centre. It is not proposed to use any bricks for lining the tank, but to render it with a coating of cement. The only place where bricks would be used would be in the dry well for the pipes, and the arch through the wall for them to enter the tank. All the parts between the new and old wall, and up to the ground level, to be of puddle and well-punned clay. By following out the plan and work named, in a proper and workmanlike manner, I have not the slightest doubt a most substantial and durable work can be accomplished, and at the least cost possible, as there are no costly materials or workmanship required, and most of what is required are near the works. I think I have made the mode I propose doing the work sufficiently clear to be understood for the present purpose, and I estimate the cost of doing the work at the sum of £6300 and £6900 respectively.

I have also made an estimate to take the main to the site at Linthorpe, which would be £5600, and if one-half was added for a return pipe, it would make the amount £8400, and it is my opinion a tank would cost more at Linthorpe than to rebuild at the Marsh, which, together with the extra cost of mains, is so much against the Linthorpe site, that I could not recommend it for your adoption.

Newcastle-upon-Tyne, March 10, 1877.

Dear Sir,—I have your communication of the 9th, in which you ask me to state the cause of failure of the present work. I was not present when the work gave way, neither did I see the place or state of the ground where the wall was founded, either where it first gave way or at any other part; but I see quite sufficient reasons, in my opinion, why it should have failed at the time it did, or would have done at a later period, when the earth was levelled up to the top of the wall to its full height, and the earth removed inside as proposed. The immediate cause of the failure was from the pressure of the loose earth behind the wall adjoining the street, assisted greatly by the water flowing from the dislocated sewers, filling all the cracks and openings in the slipping ground, thus causing the greatest possible amount of pressure both down and sideways, extending down to the base of the wall. There being no solid body placed below the base of the wall as a foundation to it, to resist the lateral pressure, and the ground being of such a tender nature that it could not bear the pressure placed upon it without the support indicated, when the counterbalancing earth was removed inside the tank, near the base of the wall, the pressure behind being greater than the tender nature of the earth could bear, forced up the ground inside the wall, and by this means formed a passage below the shallow foundation, for the loose earth and water behind the wall; and as the ground forming the foundation of the wall was carried forward into the tank, the wall failed, and was fractured as is now seen, in several places, and for a great distance from the point at which the first great failure or break took place.

I am also bound to say, after an examination both of parts of the wall which has been fractured, and where such has not been the case, I have come to the conclusion it has not been properly carried out as it should have been, the concrete being very faulty in its combination, from its not having a sufficient quantity of small material in it to form a bed for that of larger size, and from this cause it is very much weakened and liable to fracture from not being perfectly homogeneous. This is highly important when the great radius and lightness of the wall are taken into account.

I may add, in explanation of the proposed mode for building the tank, that I have fully considered the cause of failure of the present work, and provided the means to avoid it in future. The brick cylinders which I propose to use can all be sunk without disturbing the ground in any way, and when completed and filled with concrete will form a solid wall, serving both for a foundation to the wall, and when the concrete is laid around and upon them, this part of the work forms a solid dish of concrete of the great lateral depth of an arch of 24 feet, with a radius (in case the 150 feet diameter tank was adopted, and which I would recommend) of 69 feet to its radius, thus providing for a greater amount of lateral pressure than can come against it. Should you require further explanation, I will be glad to give it on application.

I remain, dear Sir, yours truly.

RICHARD CAIL.

George Bainbridge, Esq., Town-Clerk of Middlesbrough.

GAS AFFAIRS IN AMERICA.

REPORT OF THE GAS COMMISSIONERS IN RELATION TO THE SUPPLY OF GAS TO THE CITY OF BOSTON.

(*Continued from page* 426.)

Relations of Municipalities to Gas Corporations and Works.

This relation is a peculiar one in many respects. A gas company cannot be viewed in the same light as other manufacturing corporations, for many reasons. In the first place, it supplies a commodity which is not merely a luxury, but is almost a necessity. Secondly, the sale of its manufactured product is a very limited one, being confined to the limits of the city or district which it supplies; and a gas company at the present time is expected by the people to lay its pipes, so that all who desire to burn gas within the limits of a city may be accommodated. This, necessarily, in many parts of a city, entails an expenditure in distribution, which is not, perhaps for many years, repaid by the sale of gas in that special locality. And, thirdly, a very large portion of the material used (all of that used in the distribution of gas) is almost valueless for any other purpose; so that, if a company should become bankrupt, that material is not worth what it would bring for old iron, were it above ground. For these reasons, a gas company is entitled to a great deal of consideration, providing it does its duty to its customers, and is honourable in all its transactions.

The relation between municipalities and the gas corporations has been very thoroughly discussed in England, and all of the important points have been settled, to the satisfaction of all parties, by experience; so that we cannot do better than devote a little space to a short sketch of the history of the relations between the London authorities and the London gas companies.

In London, this question was brought up as long ago as 1820, and the matter was referred for investigation to a committee, the chairman of which was Sir William Congreve. This committee, after mature deliberation, recommended strongly that only one company should be allowed to supply the same district in the city, and should have the exclusive right to supply that district. Parliament, however, did not adopt this recommendation, but, on the other hand, favoured competition, by chartering new companies. The Independent Company was chartered in 1829, and competed with the Imperial, which was established in 1821. The Equitable Company was chartered in 1831, and competed with the Chartered, which was established in 1810, and was the oldest company. In 1844 Parliament permitted the establishment of the London Company, to compete with the Imperial, Equitable, and Chartered; the Great Central Company, in 1848, to compete with the two companies supplying the City, and in 1854, the Surrey Consumers Company, to compete with several companies on the south side of the Thames. The Western Company was established in 1850, and competed with the Chartered, London, and Imperial.

This condition of affairs existed from 1830 to 1857, at which time, in some of the streets, there were the mains of three or four companies lying almost in contact with each other. When a leak occurred, it was impossible to tell from which main the gas escaped; and, moreover, it was in some places impossible to state with certainty to which company a certain main belonged, so that it sometimes happened that a consumer used the gas of one company, and paid another one for it. Then, too, the additional outlay of capital in laying three or four mains when one would answer, did not tend to lessen the cost of the gas.

At this time, there were thirteen companies supplying gas to the citizens of London; in some places four or five companies competing with each other. So many difficulties arose, besides the mere price of the gas, that they mutually agreed to abandon competition and district off the City. Five of the thirteen united their interests with some of the others, thus reducing the number of companies to only eight, and recently the three companies supplying London proper—the Chartered, Imperial, and Independent—have consolidated. There was, at this time, no restriction placed by law upon the quality or the price of the gas, or upon the dividends which the companies might pay, so that the citizens of London considered themselves as completely at the mercy of the companies, and called for some legislation in regard to its supply. Consequently the "Metropolis Gas Act, 1860" was passed by Parliament, the principal points of which were—First, the companies were bound under a severe penalty, to furnish an ample supply to every one in the district requiring it, and, practically, to

extend their mains in that district wherever required, either for public or private supply. Second, they were restricted to a maximum price of 4s. 6d. per 1000 cubic feet for 12-candle gas, except in case of any extraordinary emergency, when the Secretary of State for the Home Department had power to authorize an increase of price, not exceeding 5s. 6d. per 1000 cubic feet. Third, they were subject to heavy penalties if their gas was at any time below the standard of illuminating power and purity fixed by the Act. Fourth, they were obliged to supply meters at fixed rentals. Fifth, they were obliged to publish their accounts annually, with such details as the Home Secretary might require, so as to show distinctly the amount of profit they were making. Sixth, their dividends were limited absolutely to 10 per cent., and all surplus profits beyond the amount sufficient to pay a dividend at that rate, and to form a reserve-fund of limited amount wherewith to maintain that dividend, were to be applied to the reduction of the price of gas. Seventh, power was given to the Quarter Sessions, at the instance of any two consumers, to order an investigation of any company's actions at any time, and arbitrarily to reduce the price of gas, if it should appear from such investigation that the company's profits would admit of such a reduction. In 1867 the "Revision Clauses" were proposed, lowering the price and raising the standard of the gas. They consisted of a recommendation to Parliament to empower the local authorities to erect works and supply gas if the companies would not agree to sell gas for 3s. 9d. per 1000 cubic feet of 16-candle gas; and if any company could pay a dividend of 10 per cent. at that price in any year they might do so; if they could not, they might call for the appointment of three commissioners, who were authorized to raise the price for one year if they should think best, so as to allow the companies to pay as nearly as possible 10 per cent., the system of the reserve-fund being abolished. And the local authorities might also call for the appointment of a commission, if they thought that 10 per cent. could be paid with a price of less than 3s. 9d. These conditions were incorporated into the "City of London Gas Act, 1868," to which the three companies supplying the old City of London were compelled to accede by the persistent efforts of the Corporation of the City of London to procure parliamentary authority to erect works and supply gas in the City, in competition with the companies at the expense of the public rates, and they actually called for the appointment of the commission, when, in 1872–73, and a part of 1874, on account of the coal famine, coal went up from 14s. to 32s. per ton. The contest with the London companies is still going on,* and the repeal of the revision clauses is recommended, and a sliding scale is advised in their place. This scale is, that if the price charged is more than 3s. 9d. per 1000 cubic feet, the dividend shall be cut down one-quarter per cent. for every additional penny, and, for every penny less than 3s. 9d. charged, the dividend may be increased one-quarter per cent.

Thus the necessity of having but one company supply any definite district was recognized by Parliament, and, at the same time, it was considered necessary to place some restrictions upon them as to price, quality, and amount of profit. Inspectors were also appointed, with offices supplied, at the expense of the companies, with all apparatus necessary for testing gas at a distance from the gas-works, such inspectors to report regularly upon the quality of the gas, and to have no connexion whatever with the companies.

The London JOURNAL OF GAS LIGHTING, 1876, p. 615, says:—

> With respect to the dividends and expenditures of the companies, those which supply the larger part of the Metropolis are under the active inspection of an official auditor, who is appointed by the Board of Trade for the express purpose of examining their accounts and of finding out whether any irregularity occurs. The auditor is a very different person from the ordinary, and often incompetent, shareholders auditor, who readily accepts specious explanations, and is willing to make things pleasant. The Government official takes nothing for granted; he likes his power, and uses it; he holds a continuous examination and makes minute inquiry; he is armed with supreme authority to disallow any item he may consider improper, either in principle or detail, and he is actually authorized to prevent the declaration of any dividend which he considers has not been duly earned, or is not lawfully payable. It is difficult, therefore, to conceive how more stringent precautions could be devised, or a state of things under which it would be more impossible for the companies to delude the public, even if they desired to do so, than under the existing law; and it may be added that the companies referred to, confident in their own integrity, willingly consented to submit themselves to these safeguards and precautions in favour of the consumer, in the hope that thereby they might disarm suspicion and gain confidence.

In giving the above short history of the connexion of the London government with the gas companies, it has been necessary to speak also of the results of competition in that City; that subject will, however, be again referred to.

Thus the fact, which is, at the present time, just being learned in this country, has long been established in England—viz., that the public, who are in a measure forced to use the commodity supplied by gas companies, should not be left entirely at their mercy, but should be protected to a certain extent by law, and should be ensured an article of good quality, and for a price which is not exorbitant. There is no doubt, whatever, that many gas companies in the United States have been, and still are, making very large profits by charging a high price for a poor gas. This is, however, not true of the Boston Gaslight Company, whose gas has been of a superior quality, and whose prices have been much lower as a rule, than those of other companies of nearly the same size.

The question is not merely whether the citizens of Boston are now being fairly treated in regard to price and quality, but whether they are sure of being always so treated; and in order to ensure this result, we consider that they, as well as all other gas companies in the State, should be subjected to inspection, not only in regard to the quality of their gas, but also in regard to their investments, operating expenses and profits, as is the case with the railroads throughout the State. Such an arrangement would be as much for the advantage of the companies themselves, providing that they are making and selling gas economically and honestly, as for the citizens; since it would ensure for them a monopoly, would prevent numerous applications to the authorities for permission to compete, and would do away with most of the complaints by consumers. This view of the matter will be discussed in detail later.

The arguments in favour of the manufacture of gas by the authorities themselves are, that the supply of gas is of necessity a monopoly; that economy may be effected by uniting the districts of the various companies supplying a city into one, as has been done in Philadelphia; and, thirdly, that the streets in which are located the pipes and mains are directly under the control of the city authorities. There are a number of cities in England, where the gas undertakings are in the hands of the municipalities, and among these may be especially mentioned Manchester, as one in which the management has been most efficient and successful. In some of the English towns, however, the management has not been so successful.

The gas-works are under the control of the city government in Philadelphia, Penn.; Alexandria and Richmond,† Va.; and Frankfort, Ky.‡

In Philadelphia, the gas manufacture is entirely in the hands of trustees appointed by the City Council, the works, which are very extensive, being the property of the city. This manner of election is somewhat objectionable, on account of the injurious influence which must naturally result from party politics; and so many complaints have arisen on the part of the citizens, that in 1874 a committee was appointed by them to investigate the affairs of the trust. This committee, however, found it no easy matter, and reported—"That the nature of the gas trust is such as to render a thorough investigation of its affairs impossible. No details can be ascertained, except such as the trustees themselves see fit to communicate to the public, and these are carefully doled out, so as to preclude investigation or analysis." We may, therefore, readily conclude that if this city has been successful in delivering gas to the citizens at cheap rates, while under the influence of political leaders, and the expenses being often unnecessarily increased by the employment of large numbers of voters before elections (so it was stated), it would have been possible, under more conservative management, to have furnished gas for 25 or 30 cents less per 1000 cubic feet. Thus, the price paid for coal per ton in 1875 was greater than was paid for the same coal in New York, and nearly as much as in Boston and vicinity. We should have supposed that the closer proximity to the coal region would secure to these works the material for manufacture at lower rates than those paid in Boston; but owing to some unaccounted-for discrimination on the part of the railroads, in favour of coals delivered at the seaports, we find that the Westmoreland coals at the Philadelphia works cost 6·70 dols. per ton, while 6·75 dols. was the cost in Boston during the same year. Then, too, the labour in manufacturing the gas cost about 10 cents more per 1000 cubic feet than in most other companies, which seems to confirm the statements made, that large numbers of men are employed before elections for political purposes.

Notwithstanding all the disadvantages arising from political influence in the management of these works, we find the profits for the year 1875 to have been 793,244·12 dols.; and, after deducting for interest on bonds, &c.,* the sum of 302,986·21 dols. went towards the increase of the sinking-fund, which, on Dec. 31, 1875, amounted to 2,470,193·93 dols.; while the whole amount of outstanding bonds amounted to 5,400,000 dols., thus leaving only 2,929,806·07 dols. to be provided for, when the whole works, costing nearly 14 million dols., will become the unencumbered property of the city.

The published accounts of the Philadelphia Gas Company are very defective in many respects. Thus we find that the number of public lamps is given as 10,260, and the amount of gas consumed by them as 313,373,748 cubic feet, or 30,543 cubic feet per lamp annually. This, at the rate of five feet per hour, would give as the number of hours burned, 6109 per year for each lamp, or 16 hours per day. This shows either that the city is paying for a much larger amount of gas for the street lights than is actually consumed in them—for they certainly do not burn 16 hours per day—or else that there is a waste of two or three cubic feet per hour in each lamp, since 5 cubic feet per hour of 16½-candle gas for each burner is more than sufficient. In Boston the amount is only 4 cubic feet per hour of 18-candle gas, and each lamp burns 10 or 11 hours per day.

The best argument in favour of municipal management of gas undertakings is, that about 50 cents of the price of each 1000 cubic feet of gas sold must be devoted to the payment of the dividend to the stockholders; when a much smaller amount than this, at the low rate at which money could be hired by the city, would be sufficient to pay interest on the capital, and at the same time allow a sufficient amount to be laid aside, in the form of a sinking-fund, to entirely liquedate the debt in a few years. As a rule a city cannot manufacture gas as cheaply as a private corporation, since it is almost impossible to avoid the influence of politics upon any city undertaking. Yet, notwithstanding this, the amount required to pay the dividends of a private corporation forms so large a proportion of the total price of the gas (one-fifth or one-sixth), that the loss resulting from city management can scarcely equal it. Thus the capital of the Boston Gaslight Company is 2,500,000, dols. and the amount required to pay the 10 per cent. dividend is 250,000 dols. which is 39·6 cents per 1000 cubic feet of gas sold. This does not include the interest on 500,000 dols. bonds issued.† Were this capital in the hands of the city authorities, 150,000 dols. at the most would be required to pay the necessary interest, and the capital might be diminished by 50,000 dols. or 75,000 dols. annually, by placing 2 or 3 per cent. in a sinking-fund for its liquidation. Thus a saving of 15½ cents per 1000 cubic feet would be made, granting that none of the capital were paid off, and that the city manufactured the gas as cheaply as the private corporation. This saving would naturally go on increasing year by year with the diminution of capital. The difference in the cost of manufacture and distribution by the city and that by a private corporation would not probably exceed 10 cents per 1000 cubic feet of gas sold, were the managers of the undertaking properly chosen.

While we think that gas can be made more cheaply by a well-managed private corporation than it probably would be under municipal management, and that the best plan is that adopted in London—to allow the manufacture to be continued by a corporation which shall have a monopoly of the business, under proper regulations and restrictions, in the method we have indicated—still we think there would be little risk in the undertaking by the city of Boston of the gas supply within its limits.

(*To be continued.*)

IRON AND COAL TRADES OF SHEFFIELD, SOUTH YORKSHIRE, AND NORTH DERBYSHIRE.

(FROM OUR OWN CORRESPONDENT.)

A quiet week has again to be recorded in connexion with the local iron trade, in which there are, as yet, few reliable symptoms of an improvement. Pig iron has remained fairly steady at late rates, but with a continuance of the previously reported indisposition of smelters to enter into forward engagements at current prices. At the present time North Yorkshire pigs of G. M. B. are held at the following figures:—No. 1 foundry, 47s.; No. 2 foundry, 45s.; No. 3 foundry, 43s. 6d.; No. 4 foundry, 42s. 9d.; No. 4 forge, grey, 42s.; No. 5 forge, mottled, 41s. 6d.; No. 6 forge, white, 41s.; refined metal, 61s. 6d.; Kentledge 48s.; and cinder pig, 40s. per ton, all net cash. Aireside, Leeds, No. 1, is 54s.; No. 2, 52s.; No. 3, 51s.; No. 4, 50s.; forge, 50s.; M, 49s.; and W, 49s.; all free on rails at Leeds or Hunslet. North Lincolnshire prices range from 50s. to 60s., according to brand and quality. Derbyshire pigs are being sold here at 48s. to 57s. 6d. per ton, on one month's cash terms. A special quality of pig for cylinder and other superior castings ranges from 100s. to 107s. 6d. per ton, delivered here. In the foundry departments of the leading works there is a fair amount of work in hand, chiefly in respect of the articles mentioned several times recently in these notes. The coal trade of Yorkshire and Derbyshire is in a comparatively stagnant condition, and I hear of proceed-

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* At the time this report was prepared the result of the Metropolis Gas Legislation of 1876 was not known.—Ed. J. G. L.

† The published accounts of the Richmond Gas Company, which were sent for, have not been received by us.

‡ The city of St. Louis is about to purchase the works of the St. Louis Gaslight Company. That company refused to sell to the city in 1870, at which time the city had the right to purchase according to the charter of the company, and action was taken to compel the company to sell. The court has recently decided in favour of the city.

* The outstanding bonds, on which interest to the amount of 490,257·91 dols. is paid represent, therefore, but a small portion of the cost of the works.

† The total capital of the gas companies supplying the city of Boston, not including the Brookline Company, which supplies Brighton, is 4,833,000 dols., and the total amount of gas sold by these companies in 1875 was 864,300,000 cubic feet. (No return was received from the East Boston Company, so that the amount sold by this company was estimated at 15 million cubic feet, which cannot be far from correct.) To pay 10 per cent. dividend upon this capital the citizens of Boston must expend annually 483,300 dols., or nearly 56 cents. per 1000 cubic feet.

ings on the part of one of the leading coalowners, which lead me to the belief that a further general reduction in wages is contemplated. At the Shireoaks pit the whole of the 700 men employed there have just received notice to leave in a fortnight hence. At Denaby Main, disturbances have arisen, owing to the employment of non-unionist miners, and it is feared that these breaches of the peace may assume a more decided form. In other parts of the district there is much discontent, yet I am informed, on the best authority, that the men are now getting as much coal by steady work, three or four days weekly, as they did two years ago when on full time. Prices remain very easy for all kinds of fuel, except slack coal which is again rather dearer. The coalowners have had an interview with the directors of the Great Northern line, to ask for an early and considerable reduction in the coal carriage rates to London, and their demands have been promised serious consideration. At present the average rate to London from the South Yorkshire district is 8s. 3d. per ton.

THE LANCASHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

The more winterly weather of the last few days has caused a better demand for all classes of fuel in the Manchester market, and the large firms are generally tolerably well supplied with orders for the present, whilst stocks, both at the pits and in the yards, have been considerably reduced. As, however, the improvement is solely dependent upon the weather, it can only be of a temporary character, and, generally throughout Lancashire, the round coal trade is in anything but a healthy condition. In South-West Lancashire many of the pits are still not working more than eight or nine days to the fortnight, whilst the common classes of round coal are a complete drug in the market, and difficult to sell almost at any price. Good Arley coal, at the pit mouth, is quoted at 9s. 6d. to 10s. 6d. per ton; and Pemberton four-feet, 8s 6d. to 9s.; but, for sales in bulk, somewhat lower prices would, no doubt, be accepted. Common coal ranges from 6s. 6d. to 7s. 6d. per ton at the pit, according to quality. Although common burgy is still difficult to move, the better sorts of engine fuel, and particularly good slack, meet with a ready sale at fully late prices, and the market has a decidedly stiffening tendency. Good burgy is worth about 5s. 6d. per ton at the pit, and slack from 3s. 6d. to 4s. 6d. per ton.

The shipping trade continues quiet, and prices ruling at Liverpool and Garston are still extremely low.

In the iron trade there is no improvement. North country makes of pig continue to be offered in this district at lower prices, but the local brands are without change. Finished iron has a tendency to be weaker, but the current market rates remain at £7 for Staffordshire; and £6 15s. to £6 17s. 6d. per ton for Lancashire, Sheffield, and Middlesbrough bars.

The reduction of miners wages is again being mooted in the Wigan district, and a proposal has also been made to put all the pits on short time.

THE COAL AND GENERAL TRADE OF THE NORTH.

(FROM OUR OWN CORRESPONDENT.)

The coal trade of the North of England was extremely quiet last week. It was duller than the preceding week, and the shipments were fewer. Best gas coals are coming into demand for shipment abroad as the Baltic begins to open; but there is a weaker coasting inquiry. Best gas collieries are the only pits which are kept well employed. The house collieries show a little falling off of business. All kinds of second-class coals seem to be less in demand; and the pits employed in these trades are doing less business. The prices of steam and second-class coals are a trifle lower. There has been a little better demand for manufacturing coals of late; but there is no change in value. The bulk of the miners in the North of England are badly employed. Fully two-thirds of the pits in the Northumberland steam coal-field are working no more than half time.

The coasting freight market is very dull. There is hardly any business worth mentioning transacted at present. Rates are low. A considerable fleet of small sailing vessels are in the Tyne in search of employment. Steamers are active, and as the weather is fine, they do fully two-thirds of the coasting trade, but at a very moderate rate of freight. They do not realize more than from 4s. 3d. to 4s. 6d. per ton for London. The shipping trade continues to open very quietly for the Baltic, and outward business is dull to the Mediterranean.

The iron trade of the North of England gives very little appearance of rallying. The continual depression has dissipated every appearance of prosperity from such towns as Middlesbrough, Stockton, and Darlington. None of the iron-works are doing much profitable business. Possibly from its low price, a good deal of pig iron is being shipped abroad.

Attention is being paid to the manufacture of Bessemer steel, and numerous cargoes of the finer kinds of Spanish hematite ore are imported into the Tyne to be used for that purpose.

The chemical market was quiet last week. Any little symptoms of speculation which were indicated in the business of the previous week had disappeared. A fair amount of fire-bricks and retorts have been shipped lately; but fire-brick manufacturers complain that there is not much business astir beyond meeting immediate wants.

TRADE NOTES FROM SCOTLAND.

(FROM OUR OWN CORRESPONDENT.)

It is stated that there is a probability that, at the next meeting of the Berwick Gas Company, a reduction in price of 5d., if not 10d., per 1000 feet of gas, to date from the 25th of May, will be announced. The reduction in the price of coal has already been so great that consumers are of opinion the reduction ought to be retrospective, and date from the 25th of January.

The directors of the Coldstream New Gaslight Company, considering that nothing has transpired to prevent the resolution adopted at the meeting held on the 8th of December last—"That in the event of no unforeseen contingency occurring to prevent it, the price of gas be reduced to 6s. 8d. per 1000 cubic feet, to come into operation on the 17th of February," being carried into effect, they have agreed that the price of gas be reduced accordingly.

On Monday, the 19th inst., at the monthly meeting of the Police Commissioners of Huntley, Mr. Anderson, one of the members of that body, remarked that, as the board now possessed the power, he might make a motion at a future meeting, that the gas-works be taken over by the board. Several of the members seemed to doubt whether their power extended so far as to compel the gas company to hand over the gas-works. It may be considered, however, that Mr. Anderson has given notice of motion on the subject.

The Alloa Burgh Police Commissioners met last Tuesday evening, when, after some conversation regarding the bad quality of the gas which was being meted out to the consumers, it was unanimously resolved—"That the Burghs Gas Supply (Scotland) Act be adopted in, and applied to, the Burgh of Alloa."

By the bursting of an iron plate in the tank of a large gasholder at the Nairn Gas-Works last Wednesday, a large volume of gas escaped, causing considerable alarm, but no serious consequences.

At the monthly meeting of the Forfar Corporation Gas Commissioners, held on the evening of Monday, the 19th inst., the manager submitted a report upon meters and fittings, which pointed out that complaints against the quality of the gas supplied to the town were too often founded on imperfect internal fittings. The report was referred to a committee for consideration. It was also remitted to the committee to open and dispose of the offers received for supplying higher class coal. The report upon the gas manufactured during the preceding month showed a decrease of 67,500 cubic feet, as compared with the amount manufactured in the corresponding week of last year.

Some time ago the municipal authorities of Peterhead remitted to their Lighting Committee to consider and report upon the propriety of adopting the Burghs Gas Supply (Scotland) Act, and acquiring the works and plant of the gas company. The report of the committee was submitted to a meeting of the Town Council in the early part of the past week. It was as follows:—The committee found that the Act empowered them to supply gas in two ways—first, by terms to be mutually agreed on, or to be fixed by arbitration for the acquisition of the existing gas company's works; or, second, if the gas company refused to sell the same, by the erection of new works under the powers of the Act. The latter mode might, in the meantime, be dismissed from consideration; and, with regard to the first, it appeared desirable in the outset to ascertain whether the plant of the gas company could be acquired at such a price as would enable the Town Council to supply gas to the community at a considerably reduced rate. The committee, therefore, thought that, before passing a resolution to adopt the Act, an understanding should be come to with the present gas company as to the terms on which their property could be acquired; and should the council concur in this view, it was recommended that negotiations should be forthwith initiated, and that the directors might lay before the council confidential statistics as to the present financial position of the company, so as to enable the council to arrive at an intelligent decision on the subject. It further appeared desirable that a skilled professional person should also be consulted, which would no doubt be expensive, but the committee thought the magnitude of the transfer imperatively called for the employment of such a person before the council committed themselves. Some discussion took place upon the report, after which it was agreed to remit it back to the committee, with power to do the things suggested in it.

While speaking of the movement with regard to the adoption of Sir Windham Anstruther's Gas Supply Act, it is proper I should put myself right with regard to Dumfries *v.* Johnstone. Last week I unwittingly gave the last-named town credit for having been the first to adopt the Act in all its completeness, whereas Dumfries really deserves that credit. On the 22nd of September last a special meeting of the Town Council was held for the purpose of considering the Act, when, upon the motion of Bailie Wood, it was unanimously resolved to adopt and apply the Act. This resolution was reconsidered and confirmed in the beginning of the present year.

During the week ending the 17th of March, Dr. Wallace failed to find the illuminating power of the Glasgow gas under the standard at any of the four testing-stations. In one instance the average was as high as 28·12 candles. I may here mention that at a late meeting of the Corporation Gas Committee it was resolved to instruct Dr. Wallace, when he finds the gas below the standard illuminating power at any of the testing-stations, to proceed at once to the works where the gas is made, and examine it there.

It has been resolved by the Police Commissioners of Alloa to increase the water supply throughout the town by the laying of a 12-inch main, an estimate of £1598 13s. 4d. being accepted for the same.

The Forfar Police Commissioners have now been so thoroughly "schooled" by the Board of Supervision, and frightened by the Court of Session, that they have just resolved to carry out Mr. Bateman's water supply scheme in all its entirety, at an estimated cost of £37,000.

The local authority of Aberdour have resolved to free themselves if possible from the Dour Water Scheme promoted by the Town Council of Burntisland, and to take steps to join with Inverkeithing and North Queensferry in getting a supply of water from the Devon.

On the 24th of February the water in store for Greenock amounted to 482,047,473 cubic feet, or 138 days supply for all purposes. The average consumption in the town is 53 gallons per head per day.

Last week's pig iron market closed on Friday with the price 7½d. per ton under the closing quotation on the previous Friday. The market was firm.

There is no appearance of improvement in the coal trade. Miners wages are being reduced in all directions.

REDUCTION IN THE PRICE OF GAS.—A committee of the directors of the Sheffield Gas Company have decided to recommend the board to reduce the price of gas by 2d. per 1000 feet to all classes of consumers from July 1 next. The price will then be for small consumers 2s. 11d., and large consumers 2s. 8d. per 1000 feet.

PONTEFRACT GAS COMPANY.—The half-yearly meeting of shareholders was held on the 21st ult. The directors report showed that the amount divisible was £1234 2s., out of which they recommended the payment of a dividend for the half year ending the 31st of December last, at the rate of 10 per cent. per annum. The directors also reported a considerable increase in the sale of gas during the past half year, and that the works and plant were in perfect working order and condition.

QUALITY OF THE DUMFRIES GAS.—Mr. A. Malam reports that the illuminating power of gas as tested on the works, for the week ending the 23rd inst., was as follows:—

March 17	27·20	Candles
„ 18	28·23	„
„ 19	27·75	„
„ 20	27·19	„
„ 21	28·70	„
„ 22	27·77	„
„ 23	29·52	„

Average illuminating power, 28·05 candles.

COST OF LOCAL GOVERNMENT.—At the fifth ordinary meeting of the Statistical Society for the present session, on Tuesday, the 20th inst., the President, James Heywood, Esq., F.R.S., in the chair, Captain Craigie read a paper "On the Cost of English Local Government." After pointing out the deficiencies in the returns of local finance, the recent improvements, and the points on which information was still wanting, he showed that while the cost of local government in 1868 stood at £30,237,000, of which pauperism cost £7,419,000, or 24½ per cent., it had risen in 1874-75 to £41,877,000. The cost of pauperism alone showed a decrease since 1868 of £738,000, or nearly 10 per cent., every other head of expenditure had risen to a net increase of total outlay of £11,640,000, or 38½ per cent. The largest share of this increase was due to the "so-called" sanitary expenditure of provincial towns, who now spend £7,646,000 more than they did seven years ago. The local debt was £94,000,000 at the present time. The great diversity in the objects of local governments precluded reliable comparisons between districts. In Birmingham only £1 14s. 5d. seemed to be spent, against £5 4s. in Manchester. Five great towns—viz., the Metropolis, Liverpool, Manchester, Birmingham, and Leeds—containing one-fifth of the population of England, account for about one-third of the local

expenditure of the country and owe one-half of the debt. He also dealt with the complex organization and vast number of local authorities, showing that 12,336 such bodies existed. He noticed the large number of paid officials required by these varied governments, annually receiving £2,400,000 in salaries. In conclusion, he urged the need for more uniform and complete statistics, a better system of local finance, and a regular official audit in all cases, and enforced the advantages which might be derived by consolidating local governments, concentrating local functions, and establishing powerful provincial authorities in county areas, which should strengthen local institutions, and introduce greater economy, efficiency, and uniformity into our local system.

Glasgow Corporation Water Supply—Estimates for 1877-78.—At the meeting of the Glasgow Water Committee, on the 20th inst., the Finance Sub-Committee reported that a statement of the probable revenue and expenditure for the current year showed an estimated surplus of £2847, which was recommended to be carried to the sinking-fund. The estimate of revenue and expenditure for 1877-78 was submitted, the revenue being stated as under:—Domestic water-rate within compulsory limits, at 8d. per pound (as at present), £39,244; less abatements, £2940—£36,340; domestic water-rate, beyond compulsory limits, at 11d. per pound (as at present), £25,672; less abatements, £1170—£24,502; public water-rate, at 1d. per pound (as at present), £11,958; trade charges (as at present), £24,300; meter-rates (as at present), £41,857; new buildings (as at present), £2000; arrears, £600; costs, £250; ground annuals, &c., £720—£142,491. Less deficiency in revenue account of river supply works *ut infra*, £2198: total, £140,293. The estimated expenditure was £119,864, and that sum, with £13,720 to the sinking-fund at 1 per cent., being deducted from the revenue, £119,864, a surplus was left of £6709. The river supply account was as follows:—Revenue from water supplied for nine months, £3309; excess of expenditure over revenue, £2198—total, £5507. The cost of pumping and management for the period was stated at £1237, the interest was given as £3392, and £878 was set down for the sinking-fund—total, £5507. The Sub-Committee recommended the Water Committee to report to the commissioners that they were of opinion the sum to be set apart as a sinking-fund for 1877-78 should be £14,598—*i.e.*, £13,720 for the "Glasgow water account," and £878 for the "River supply account"—being at the rate of one per cent. on the amount of money borrowed; that the amount of the domestic water-rate to be assessed and levied within the limits of compulsory supply for the said year, should be continued at 8d. in the pound; that the amount of the water-rate to be levied beyond the limits of compulsory supply, but included within the limits of the Glasgow Corporation Water-Works Act, 1855, should be continued at 11d. in the pound; that the public water-rate should be continued at 1d. in the pound; and that the present table of rates and charges for supplies of water for other than domestic purposes should not be altered, except in the following particulars:—That the charge for supplies by meter be reduced from £1 17s. 6d. per 100,000 gallons to £1 13s. 4d.; that the charges for bottlers, &c., be reduced from 10s. and 7s. 6d. per 50 gross bottles, to 7s. 6d. and 5s. 6d.; that the charge for pasture fields be reduced from 5s. to 3s. per acre; that the minimum charge for licensed grocers be reduced from £1 to 10s.; that the charge per stall for livery stables be reduced from 4s. to 3s.; that the charge for first-class schools and seminaries be reduced from £1 to 10s. for each pipe, closet, or urinal; and that it be optional for builders to take a supply through meter at a minimum charge of £10.

Drainage of London.—At the meeting of the Sanitary Institute of Great Britain on the 14th inst., Sir Joseph W. Bazalgette (vice-president) said the conditions essential to the health of cities and towns were pure air and a pure and abundant supply of water. The means, however, of removing from towns rapidly, and without contamination, the rainfall, and drying the subsoil, and removing all decomposition in the most efficient manner, was a subject upon which there was a great variety of opinions. He regarded the report of the committee appointed by the President of the Local Government Board rather as a record of failures than successes; but it was useful, inasmuch as failures taught one what to avoid. He quoted the various conclusions of the committee, and gave a number of instances to show that the value of sewage for manuring land was greatly exaggerated. Some 30 or more years ago London sewage was thrown into cesspools, and that was a horrible state of affairs, the ground being saturated with sewage. It was then wisely decided that cesspools should be destroyed, and that the sewage should be turned into sewers, the result of which was that the Thames became polluted, and that gave rise to an Act resulting in the carrying out of the main intercepting system, and the diversion of the sewage from the river. In London was seen the best example of the disposal of sewage on the principle of carrying it all away by the water carriage system, and putting it into the tidal outfall. The expenditure in London, inclusive of interest on capital borrowed for the construction of the main sewers, and inclusive of the annual cost of pumping 136 million gallons daily in dry weather 35 feet high, and all cleansing and maintaining, had been at the rate of 1s. per head per annum. But had London adopted one of the pocesses of purification, and obtained 60 square miles of land for a sewage farm (which was the extent which would be necessary), it would have led to a large failure and costly delay. Comparing London with Paris, he said that the latter had adopted a system of removing sewage by pails; the cost of constructing their main sewers had been £4,000,000 (the same as that of London); and the cost of cleansing and repairs in Paris, where there was no pumping, had been £59,000 per annum, or 6d. per head of the population. In London, where the sewage was lifted an average height of 35 feet, the cost was only £58,000, or 3½d. per head of the population, although we had the additional work of pumping. In Paris they removed the soil by carts, and in 1869 they removed 600,000 cubic mètres by their process, which cost them 2s. 3½d. per head. If their process were applied to London, it would mean that in London an additional £487,000 per annum would have to be expended. The conclusion at which he had arrived was, that no one system for dealing with town sewage could be advocated as suitable for all places. He believed that cesspools, middens, and dry earth systems were objectionable for towns, and that purification by chemical means was costly and unsatisfactory, and should only be adopted in exceptional instances.

The GRAND MEDAL of MERIT at the VIENNA EXHIBITION, and TWO MEDALS at the PHILADELPHIA EXHIBITION, have been AWARDED to GWYNNE & CO. for GAS-EXHAUSTERS, ENGINES, and PUMPS;
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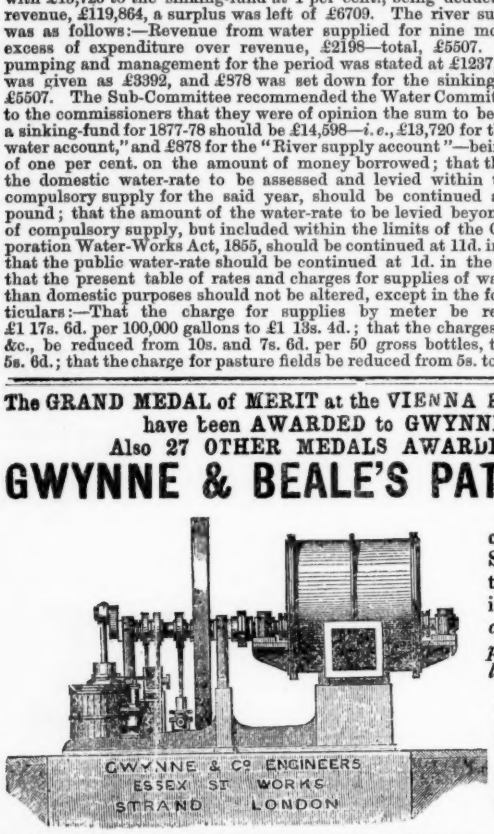
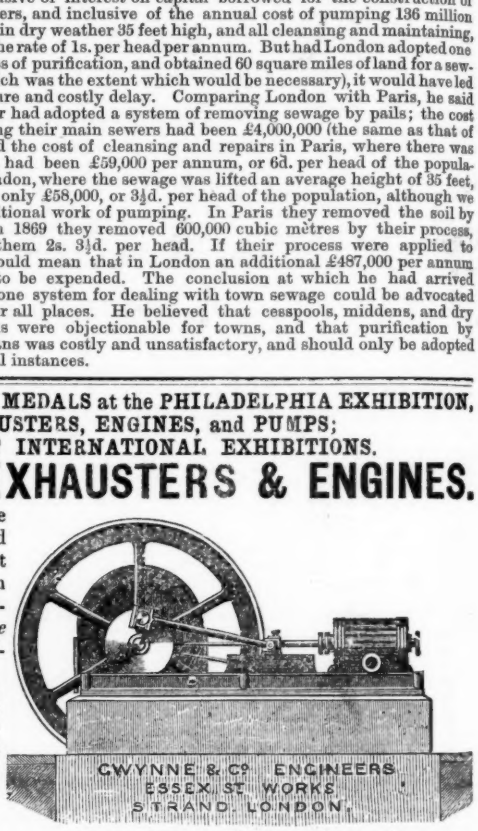


EXHAUSTER with Trunk Engine, capable of passing 210,000 cubic feet per hour.

The Judges report on the combined Exhauster and Steam-Engine exhibited at the Philadelphia Exhibition is—"*Reliable compact Machine, well adapted for the purpose intended, of excellent workmanship.*"

GWYNNE & CO. have made the largest and most perfect Gas-Exhausting Machinery in the world, and have completed Exhausters to the extent of 7,000,000 cubic feet passed per hour, of all sizes from 2000 to 210,000 cubic feet per hour.



52,500 EXHAUSTER, with Horizontal Engine combined.

GWYNNE & CO. do not pretend to enter into a struggle with other makers in respect to cheapness. They have never sought to make price the chief consideration, *but to produce machinery of the very highest quality, and most approved design and workmanship.* The result is that in every instance their work is giving the fullest satisfaction. Numerous testimonials and references can be given to Companies using their Machinery for years past.

Exhausters, with or without Engines combined, can be made to pass the gas without oscillation or variation in pressure.
Regulators, Bye-Passes, Stop-Valves, Gas-Valves, Station Governors, and Gas Machinery of all Sizes.

PLEASE ADDRESS IN FULL, GWYNNE & CO., Hydraulic and Gas Engineers,
ESSEX STREET WORKS, VICTORIA EMBANKMENT, LONDON, W.C., ENGLAND.

☞ *G. & Co. are now making 6 Sets Exhausters and Engines for 105,000 cubic feet per hour, 3 Sets 180,000 Exhausters and Engines, with many others of all Sizes.*

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A SECOND EDITION (fcap. 8vo., morocco gilt)
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Tables, Rules, and Useful Information for Gas Engineers, Managers,
And others engaged in the Manufacture and Distribution of COAL GAS.
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WANTED, a steady middle-aged Man as FIRST MAIN AND SERVICE LAYER.
Address, stating age, wages, and full particulars, No. 354, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, by a Lancashire Manufac- turing Chemist, large or small quantities of strong Gas AMMONIACAL LIQUOR, above 8° Twaddel.
Address No. 353, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

METER REPAIRER.

WANTED, at the Reading Gas-Works, a steady and experienced METER REPAIRER. Used to both Wet and Dry Meters. The situation is a permanent one.
Apply, stating age, experience, and wages required, to Mr. E. BAKER, Engineer.

WANTED, immediately, a Draughts- man. Must be thoroughly acquainted with the construction of gas-works and plant, &c.
Address, stating age, salary required, and all particulars, to W. LITTLEWOOD, Gas-Works, Rochdale Road, MANCHESTER.

WANTED, by a respectable Young MAN, aged 20, a situation as CLERK and COLLECTOR in a Gas-Work where opportunity is afforded to learn the main-laying and gas-fitting. Four years good reference.
Address P., Gas-Works, Builth, BRECON.

WANTED, a situation as a Working MANAGER in a small Gas-Work. Well up in manufacturing and purifying gas. Can do all main and service laying, and all fittings in works and out.
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PLUMBER AND FITTER.

WANTED, by the Cambridge University and Town Water-Works Company, a PLUMBER and FITTER. One accustomed to a water-works preferred. Wages 30s. per week.
Applications to be made, not later than Tuesday, the 3rd day of April, to the Company's Engineer, Mr. HENRY TOKLISON, 4, Bene't Street, CAMBRIDGE.

WANTED, by the Ringwood Gas Com- pany, a New GASHOLDER of the following dimensions:—Depth, 10 feet; width across from out to out, 30 feet.
The Company are prepared to receive tenders for the same, but do not pledge themselves to take the lowest tender.
Tenders to be sent to H. R. MORANT, Esq., Manor House, Ringwood, HAMPSHIRE.

THE late Storekeeper and Clerk, and Pay Clerk to the Commercial Gas Company, for the last five years, is desirous of meeting with a similar SITUATION, or as Commercial Traveller, or London Agent for one or more good firms. The Advertiser is thoroughly competent to take the responsibility of buying, and the entire control of the stores, and would desire a salary which would render anything but the interest of his employers out of consideration.
Address Mr. CHARLES F. RESTELL, 33, Bloomfield Road, Burdett Road, Bow, E.

WANTED, a situation as Manager of Gas-Works on a gentleman's estate, or in a small village. Thoroughly understands every branch, erections, fittings, &c.; 14 years excellent character.
Address, A. FIELD, Binfield, near Bracknell, BERKS.

TO BE LET or SOLD, a Property in the vicinity of London, admirably adapted for the erection of Water-Works, having an abundant supply of the purest spring water from the chalk.
For further particulars, apply to DRIVER AND HAYWOOD, 5, Victoria Street, WESTMINSTER, S.W.

TO BE SOLD, Four Cast-Iron Purifiers, 6 ft. square, with hydraulic centre-valve; also Ten 18-in. round, and Sixty-two 15-in. round Retort Mouthpieces, and Forty-seven 6-in. H-Pipes.
Apply to W. WINSTANLEY, Manager, Gas-Works, NEWCASTLE-UNDER-LYME.

READING GAS COMPANY.

FOR SALE, as they now stand, and at any reasonable price, as the ground upon which they stand is wanted, four 12-ft. square Cast-Iron PURIFIERS, with centre-valve and connexions, grids, tee bars, &c., complete.
Apply to Mr. E. BAKER, Engineer, Gas-Works, READING

WALTON-ON-THAMES AND WEYBRIDGE GAS COMPANY.

FOR SALE, Three Engines and Ex- hausters (Two by Gwynne, and one by Waller) for 15,000 feet per hour. Being about to be replaced by larger ones.
Can be seen at the Works, Walton-on-Thames, or particulars can be had of Mr. GEORGE ANDERSON, 35A, Great George Street, WESTMINSTER.

GASHOLDERS.

FOR SALE, Two Telescopic Gasholders. One 50 ft. by 16 ft., the other 70 ft. by 20 ft., each complete, with cast-iron tanks, columns, girders, and inlet and outlet pipes, valves, &c., both of modern construction, in good condition, and made by Messrs. Piggott and Co., of Birmingham. To be seen at work at the Gas-Works, Birkenhead. Cause of removal to make room for extensions.
To be sold a bargain, taken down and re-erected ready for work.
For particulars apply to ASHMORE AND WHILE, STOCKTON-ON-TEES; or to view, apply to Mr. CALLOW, Gas Engineer, BIRKENHEAD.

THE Swansea Gaslight Company have for immediate SALE, the following Plant:—
A 6-h.p. Patent Trunk Engine. (Beale.)
Exhauster to pass 15,000 feet per hour. (Beale.)
An 8-h.p. Grasshopper Engine. (Easton and Amos.)
Exhauster, 20,000 ft. per hour. (Beale.)
Tar, Liquor, and Water Pumps, Eccentrics, Shafting, and Driving Pulleys.
Wrought-iron Condenser, six vertical Legs, 30 ft. high, 24 in. by 6 in., with tar-boxes, dips, and syphons.
A set of four cast-iron Purifiers, 12 ft. square by 5 ft. deep, with galvanized wrought-iron covers, lifting apparatus, four tiers of wooden sieves, 10-in. connexions and valves.
May be seen at the Gas-Works, Swansea. The whole in perfect working order; replaced by plant of larger dimensions.
Further particulars may be obtained on application to Mr. THORNTON ANDREWS, SWANSEA.

NAPHTHA.

THE Undersigned are prepared to give the highest market value for genuine crude COAL TAR NAPHTHA.
Address HAMILTON MACBEAN & Co., Blackhorse Bridge, Deptford, LONDON.

BELFAST CORPORATION GAS-WORKS.

THE Gas Committee of the Belfast Town Council invite ESTIMATES for the taking down and rebuilding of a Bench of RETORTS, containing 12 arches (single retorts). The work will include resetting of retorts.
Estimates must be received on or prior to April 16, 1877.
Full particulars may be obtained on application to
JAMES STELFOX, Engineer and Manager.

THE Blackburn Gaslight and Coke Com- pany have FOR SALE one 25,000 feet per hour EXHAUSTER and ENGINE combined, with one 10-horse power BOILER. The Exhauster is by Musgrave and Co., of Bolton, and is only to be sold as it has been replaced by a larger one. Also four Wrought-Iron GIRDERS, 32 ft. long, 18 in. deep, 17 in. wide, double plated, at top, bottom, and web, with ½-in. plates.
Application for price, &c., to be made to the undersigned.
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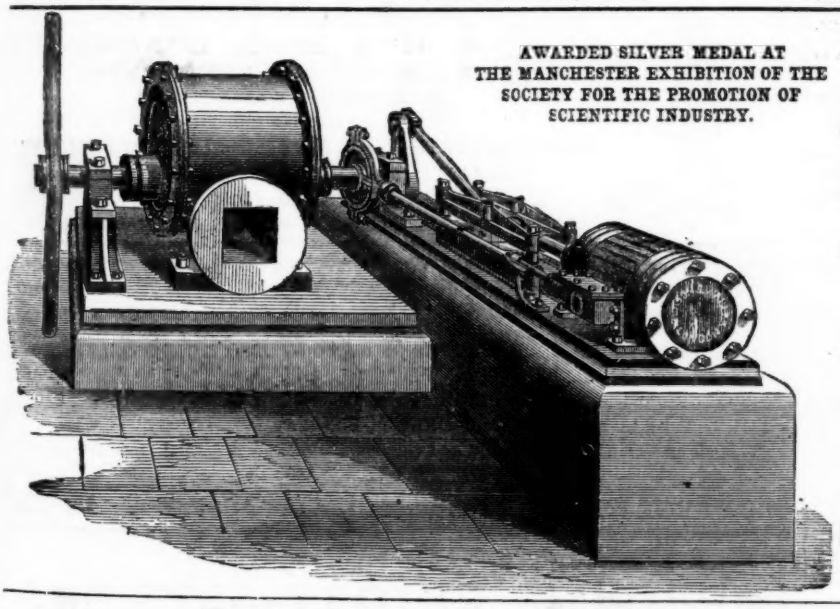
THE Kingston-upon-Thames Gas Com- pany have FOR SALE, cheap, second-hand PLANT as under:—
Two 12-ft. square PURIFIERS, with wrought-iron lids and lifting apparatus complete.
A quantity of 9-in. RACK-VALVES and connexions.
A Cornish BOILER, 4 ft. diameter by 10 ft. long, with safety-valves, furnace work, &c., complete.
A STATION-METER, made by Parkinson, to pass 20,000 feet per hour.
The whole of the above have been thrown out of use to make room for plant of larger dimensions.
H. F. PACKHAM, Engineer and Manager.

LOUGHBOROUGH GAS COMPANY.

THE Directors invite Tenders for the purchase of the surplus GAS TAR and AMMONIA WATER manufactured at their works, in quantities (per year) of about 180 tons Tar, and 300 tons Ammonia Water (6° Twaddel), for a term not exceeding Three years, from the 1st of June next.
Terms of payment ten days after each quarter-day.
Tenders to be addressed to me not later than April 9, 1877.
J. B. BALL, Manager.

WIGAN BOROUGH GAS-WORKS.

THE Gas Committee of the Corporation of Wigan invite TENDERS for the construction and erection of a GASHOLDER, 150 ft. diameter, in two lifts of 30 ft. each.
Also for the construction of a BRICK TANK for same.
Also for the supply and fixing of two SCRUBBERS, 60 ft. high and 10 ft. diameter, of approved make, and two PURIFIERS, each 20 ft. square and 5 feet deep, with all necessary valves and connexions for same.
Plans, specifications, and other particulars may be obtained on application to Mr. J. G. Hawkins, the Engineer.
Tenders to be sent in, addressed to Mr. Hawkins, not later than Tuesday, the 17th of April next, endorsed "Tender for," &c.
The Committee do not bind themselves to accept the lowest or any tender, and reserve to themselves the right to accept a portion only of any tender.
MASKELL WM. PEACE, Town-Clerk.
Wigan, March 23, 1877.



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FOR STATIONS, DISTRICTS, DWELLING-HOUSES, AND PUBLIC LAMPS,
OF WHICH UPWARDS OF 90,000 ARE NOW IN SUCCESSFUL USE.
"These Lamp-Governors are so superior that they are likely to supplant all others."—*Dr. Wm. Wallace, F.R.S.E., F.C.S.*

STATION-GOVERNOR.

THE Gas Committee of the Corporation of Carnarvon invite TENDERS for the supply of a STATION-GOVERNOR, with 14-inch connexions.

Sealed tenders, endorsed "Tender for Governor," and addressed to "The Chairman of the Gas Committee," to be sent in not later than the 16th of April prox.

MAT. J. PARSONS, Manager.

Gas Office, Carnarvon, March 24, 1877.

TO GASHOLDER MAKERS.

THE Gas Committee of the Corporation of Carnarvon invite TENDERS, with plans and specifications, for the supply and erection of a Single-Lift GASHOLDER of 80,000 cubic feet capacity.

The Committee do not bind themselves to accept the lowest tender, nor to make any allowance for the plans and specifications.

For further particulars, apply to the undersigned.

Sealed tenders, endorsed "Tender for Gasholder," and addressed to "The Chairman of the Gas Committee," to be sent in not later than the 16th of April prox.

MAT. J. PARSONS, Manager.

Gas Office, Carnarvon, March 24, 1877.

MAIN-PIPES.

THE Gas Committee of the Corporation of Carnarvon invite TENDERS for the supply of

700 yards 14-in. Cast-Iron Pipes, turned and bored.
240 „ 14-in. „ „ open socket.
70 „ 12-in. „ „ „
350 „ 3-in. „ „ „

with the necessary bends, tees, &c.

Specifications may be obtained from the undersigned.

Sealed tenders, endorsed "Tender for Main-Pipes," and addressed to "The Chairman of the Gas Committee," to be sent in not later than the 16th of April prox.

MAT. J. PARSONS, Manager.

Gas Office, Carnarvon, March 24, 1877.

TO TAR DISTILLERS.

THE Directors of the Wakefield Gaslight Company are desirous of receiving TENDERS for the surplus TAR produced at their works, for One or Two years, from the 1st day of April next.

Sealed tenders to be sent to the undersigned not later than Monday, the 2nd day of April, 1877, by Twelve o'clock at noon, stating price per ton, and whether for One or Two years. Carbonize 15,000 tons of coal per annum.

By order,
JOHN WHITAKER, Secretary.

Gas-Office, Wakefield, March 20, 1877.

TO GASHOLDER MAKERS.

THE Directors of the Market Har-borough Gas Company are prepared to receive TENDERS for a Single-Lift GASHOLDER, 60 ft. in diameter and 18 ft. deep.

Plans and specifications may be seen at the Works of the Company, at Market Harborough, or on application to Mr. John Eunson, C.E., Northampton.

Tenders addressed to the Secretary, endorsed "Tender for Gasholder," to be delivered on or before the 31st of March.

By order,
JOHN LESTER, Secretary.

Market Harborough, March 2, 1877.

HONITON GAS AND COKE COMPANY.

TENDERS are invited for a Lease of the works of the above Company, situate at Honiton, in the county of Devon.

Quantity of gas made last year, as returned by the present lessee, 4,000,000 cubic feet.

The term of the Lease will be for Ten years, from Midsummer, 1877.

Further particulars may be obtained on application to the Secretary.

A draft of the Lease may also be seen.

Sealed tenders to be addressed to the Secretary on or before May 1, 1877.

JOHN MURCH, Secretary.

Honiton, March 22, 1877.

FRAMLINGHAM GASLIGHT COMPANY, SUFFOLK.

THE Directors of the above Company are prepared to receive TENDERS for alterations at the Gas-Works:—

A new Hydraulic Main, Condensers, Purifiers, Gasholder, &c., and a quantity of new Mains.

Plans and specifications may be seen at the Secretary's, or copies of the same will be sent on receipt of P.O.O. for 7s. 6d., payable to Joseph Barker, jun.

Sealed tenders to be sent to the Secretary on or before the 25th of April next.

By order,
JOSEPH BARKER, jun., Secretary.

Bridge Street, Framlingham, March 24, 1877.

GASHOLDERS FOR SALE.

THE Dewsbury Corporation hereby offer FOR SALE Two GASHOLDERS, which, until recently, have been in use at their Batley Carr Gas-Works.

One Telescopic Gasholder, 74 ft. diameter, in two lifts, each 18 ft. deep, with columns, guides, girders, with balance-weights, &c.

One Telescopic Gasholder, 58 ft. diameter, in two lifts, each 16 ft. deep, with columns, guides, girders, &c.

Particulars may be obtained on application to the undersigned.

Sealed tenders, stating price, to be sent to Jesse Smith, Esq., Town-Clerk, not later than Tuesday, April 3, 1877.

The Corporation do not bind themselves to accept the highest tender.

CHARLES A. CRAVEN, Engineer and Manager.

TO COALOWNERS.

THE Directors of The Gaslight and Coke Company are prepared to receive TENDERS for a supply of Common and Cannel COAL in accordance with specifications to be obtained at this Office.

The principal works of the Company are accessible by railway, in direct communication with all the inland coalfields, as well as by screw colliers from the northern coalfields.

Tenders are to be sent in to me on or before Tuesday, the 3rd of April.

By order,
JOHN ORWELL PHILLIPS, Secretary.

Chief Office, Horseferry Road, Westminster, S.W.,
March 21, 1877.

SOUTH METROPOLITAN GASLIGHT AND COKE COMPANY.

NOTICE is hereby given that the ORDINARY HALF-YEARLY GENERAL MEETING of the PROPRIETORS of this Company will be held at the Bridge House Hotel, London Bridge, S.E., on THURSDAY, the 5th day of April next, at Two o'clock in the afternoon precisely, to receive the Directors Report and the Accounts of the Company for the half year ended the 31st of December last, to declare a Dividend, and to elect a Director in place of T. B. Simpson, Esq., who retires from office at this meeting, but being eligible offers himself for re-election; and an Auditor in place of A. F. Paull, Esq., resigned.

Any Proprietor holding shares on which £2000 have been paid up, intending to become a candidate for either of these offices, must give notice in writing at the Office of the Company, at least 14 days previously to the date of election.

The Transfer Books will be closed from the 22nd day of March until after the Meeting.

By order,
GEORGE LIVESEY, Secretary and Engineer.

589, Old Kent Road, S.E., March 14, 1877.

THE GAS TRADE CIRCULAR AND REVIEW, just published, contains: Chap. VI. The Carbonization of Coal. Chap. V. Book-keeping for Gas Companies. Explosive Gases, &c. Price 3d.; 12 Copies by post, paid in advance, 3s. 3d.

Address GAS REVIEW, St. Stephen's Chambers, Telegraph Street, LONDON, E.C.

BAILEY'S Patented Inventions are now in extensive use wherever steam is known. Bailey's Patent Steam Gauges, Pyrometers, Water Gauge Cocks, Test Pumps, Fusible Plugs, Steam and Water Valves, Safety Valves, Junction Valves, Pumps, Tell-Tales, Recorders, Lightning Conductors, Electric Telegraphs, Turret Clocks, Steam Joint Cement, Lifting Jacks, Boiler Feeders, Lime Catcher and Separator, Injectors and Ejectors, and every description of first-class Brass Work for Engines and Boilers. Gas-Works Managers who have not our large book should send for it.

16th edition, 1000 engravings, 4to., post free 3s. 6d. in stamps, weight 10 oz., cost of production £1000.

BAILEY'S Illustrated Inventions, containing details and prices of goods in our five several departments:—(1) Brass Foundry, Steam Gauges, Indicators, Feeders, and Fittings; (2) Engineers Sundries, Small Tools, and Stores; (3) Machine Pump and Fire Engine; (4) Turret Clock, &c.; (5) Electric Telegraph, A B C Instruments, Bells, and Apparatus.

W. H. BAILEY and Co., Albion Works, Salford, LANCASHIRE.

NEWMARKET GAS COMPANY.

THE Directors of the above Company are prepared to receive TENDERS for the supply of the following Cast-iron PIPES with turned and bored joints, with bends, syphons, &c., delivered at Newmarket Station:—

	Weight per yard.
900 yards 8-in., 9 ft. lengths . . .	126 lbs.
900 „ 9-in., „ „ . . .	149 „

Further particulars may be obtained on application to the undersigned, to whom tenders are to be sent on or before April 4, 1877.

The Directors do not bind themselves to accept the lowest or any tender.

By order,
THOMAS WILKINSON, Manager.

Newmarket, March 21, 1877.

JOHN ROMANS, C.E., F.G.S.E.,
CONSULTING GAS ENGINEER
AND
CANNEL COAL FACTOR,
30, St. Andrew Square, EDINBURGH.

Plans and Estimates furnished; Gas-Works, Apparatus, Pipes, Machinery, Fire Goods, &c., supplied, or Attested and Shipped for Exportation.

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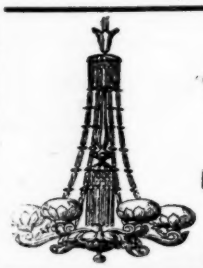

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TABLE GLASS OF ALL KINDS.

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CAST-IRON RETORTS, SOCKET-PIPES for GAS or WATER PURPOSES, FLANGE-PIPES for STEAM, RAIN-WATER PIPES and GUTTERS, HOT-WATER PIPES and BOILERS, and all requisite Connexions for same; also LAMP-COLUMNS, LAMPS, WROUGHT FRAMES, WROUGHT-IRON TUBING, &c., &c.

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THE GAS & WATER COMPANIES DIRECTORY

FOR THE YEAR 1877,

EDITED BY

CHARLES W. HASTINGS,

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CONTAINS

- An Alphabetical List of Towns in England having Gas or Water Companies.
- Date of Formation of the Company.
- If Incorporated under Special Act of Parliament, and the date of such Act or Acts.
- If under any of the Limited Liability Acts.
- Amount of Share Capital.
- Name of Chairman.
- Name of Engineer or Manager.
- Name of Secretary.
- If Let on Lease, Name of Lessee.
- If a Private Venture, Name of Owner.
- If Purchased by the Corporation (and in cases where possible the date of such Purchase), or if the Property of the Local Authorities.
- Population of all Towns.
- Railway Communication, and the Distance from London.
- Special Notice is taken of all the Members of the "British Association of Gas Managers."

THIS WORK IS UNDER THE PATRONAGE OF ALL THE LEADING GAS & WATER ENGINEERS AND SECRETARIES OF THE METROPOLITAN & PROVINCIAL COMPANIES.

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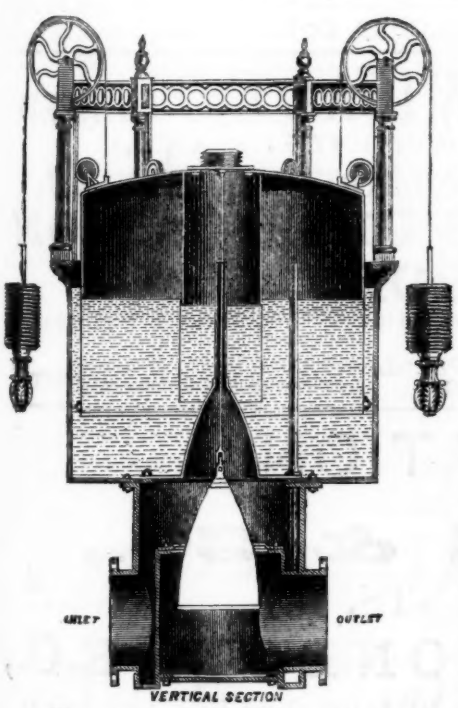
Beg to submit to Gas Engineers their

PATENT COMPENSATING GAS GOVERNOR,

Which is designed to give an uniform pressure at the Outlet to the Main at all draughts up to the full quantities which the Governors are made to control, such outlet pressure being less than the initial pressure.



VERTICAL SECTION

The uniformity of pressure is obtained by introducing a compensating chamber into the Bell or Holder of the Governor, which compensator is of the same area as the valve, both of which are operated on by the initial pressure, thereby placing the valve in equilibrium, no matter what the initial pressure may be. The action on the Bell is by the Gas passing along a pipe from the outlet, and the pressure is regulated by weights in connexion with the Bell as required.

From the sectional elevation attached hereto, it will be seen that only the Gas required to operate the Bell comes in contact with the water of the tank, which water will remain comparatively sweet and free from odour. That in case of accident to the Bell, no more Gas can escape than would pass up the pipe covering the valve-rod and Bell supply-pipe.

These Governors have been made and sent out of various sizes for from 2 to 24-inch Mains, and give most satisfactory results.

They can be made with Float in the Bell, or counterpoise as per section.

BOROUGH OF PORTSMOUTH WATER-WORKS COMPANY.

TENDERS FOR LAYING AND JOINTING CAST-IRON PIPES AND OTHER WORKS.

THE Directors of the Borough of Portsmouth Water-Works Company are prepared to receive sealed TENDERS for the laying and jointing of about 20,000 yards of 12-in. and other PIPES, and sundry work in connexion therewith, from the Company's high level reservoirs on Portsdown Hill, to the town of Portsmouth.

Copies of conditions of contract, specification, and form of tender may be obtained at the Secretary's Offices, 31, St. Thomas Street, Portsmouth, or at the Offices of Messrs. Joseph Quick and Son, C.E., 29, Great George Street, Westminster, on and after Monday, the 26th inst., and tenders must be delivered at the Company's Offices, at Portsmouth, at or before Ten o'clock in the forenoon of Wednesday, the 4th of April next.

The tenders to be addressed to the Directors, under cover to the Secretary, and marked "Tender for Pipe-Laying."

Parties tendering will be required to send with their tenders a statement or certificate of their having executed work of a similar character satisfactorily. Bond or security to the amount of £1000 will be required.

The Company do not pledge themselves to accept the lowest or any tender.

By order,
R. W. FOND, Secretary to the Company.
Portsmouth, March 16, 1877.

TO GAS & WATER COMPANIES, & MUNICIPAL AUTHORITIES SUPPLYING WATER OR GAS.

CONSPIRACY AND PROTECTION OF PROPERTY ACT, 1875.

It is required, under a PENALTY OF FIVE POUNDS, that a PRINTED COPY of the 4th SECTION of the above Act shall be posted up at all Gas and Water Works in a conspicuous place, where the same may be conveniently read by the persons employed thereat.

Printed copies of the section, in large type, on broad sheets, may be had of WILLIAM B. KING, 11, Bolt Court, Fleet Street, LONDON. Price, per post, 2s. per dozen, or 10s. 6d. per 100.

The Act extends to Scotland and Ireland.

GAS-WORKS CLAUSES AMENDMENT ACT, 1871.

ANNUAL ACCOUNTS OF GAS COMPANIES.

FORMS OF ANNUAL ACCOUNTS, arranged as required by the 35th Section of the Act (34 & 35 Vict., cap. 41), are now ready.

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Published by EDWARD SANDELL, Accountant, 4, Skinner's Place, Size Lane, QUEEN VICTORIA STREET, and W. B. KING, Office of the JOURNAL OF GAS LIGHTING, 11, Bolt Court, FLEET STREET, E.C.

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ENGINEER,
AND
CONSULTING GAS ENGINEER,

BROOKLYN, CHEETHAM HILL ROAD,
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TO INVENTORS AND PATENTEES.

MR. W. H. BENNETT, having had considerable experience in matters connected with Gas, Water, and Sanitary Improvement, begs to say that he continues to assist Inventors in the perfection of their designs, and to obtain for them PROVISIONAL PROTECTION, whereby their invention may be secured for Six Months; or LETTERS PATENT, which are granted for Fourteen Years.

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CLAYTON, SON, and CO. beg to call the attention of their friends to the fact that they have REMOVED from their Old Works in Belinda Street, Church Street, Hunslet, to their new place of business, PROVIDENCE IRON-WORKS, near the Railway Station, Moor End, Hunslet, Leeds.

Their New Works are much more commodious. In them they have put down improved machinery for the manufacture of Gasholders, Boilers, Roofs, &c.

C. S. & Co. take this opportunity of thanking their friends and the public for past favours, and trust they may be supported in the future. All orders entrusted to their care shall have their usual prompt and careful attention, and will be executed in the best workmanlike manner, as in the past.

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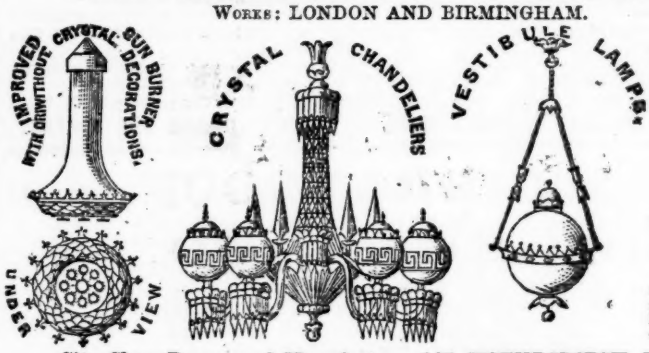

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POWER METER

For showing the Illuminating Power of Gas by the observation of one minute.

£26 3s. 10s. COMPLETE.

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For 14-candle and 16-candle gas, as certified by the Board of Trade, is now ready.

Prices and Description of above will be sent on application.

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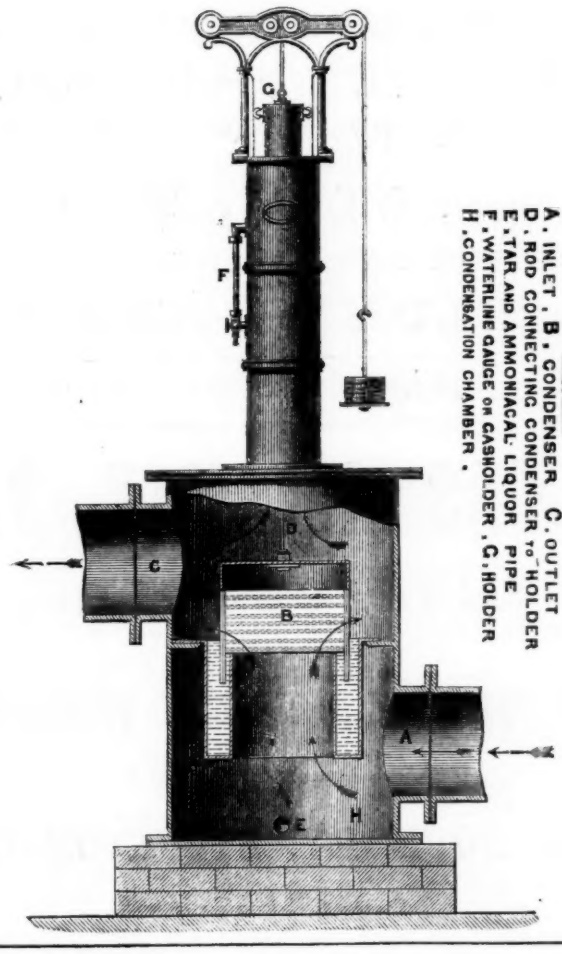

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Suitable for the English and French systems.

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"EVANS"

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PHOTOMETERS,

As approved of by the Metropolitan Gas Referees and Standards Department of Board of Trade.

Lists of above will be sent on application.

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GLASGOW;

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Manufacturers of

CAST-IRON GAS AND WATER PIPES.

SIZES: ¾ to 12 inches at GLASGOW.

„ 1½ to 7 „ STOCKTON.

A LARGE STOCK KEPT, AND PRICES MODERATE.

Freight to London, in the Stream, 10s. per ton from Stockton; 12s. 6d. from Glasgow.

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The repair, alteration, and adjustment of all kinds of Wet and Dry Meters is a matter to which we have long devoted very special attention, a large part of each of our factories in London, Manchester, and Edinburgh being occupied by work of that kind.

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London, Manchester, and Edinburgh are peculiarly well adapted, by situation and importance, for the requirements of our business, and especially is this the case in the facilities afforded by our three factories for efficient, prompt, and economical repairs.

Wet and Dry Meters of every kind, and of any maker, repaired, altered, and adjusted at prices which we shall be happy to furnish on application.

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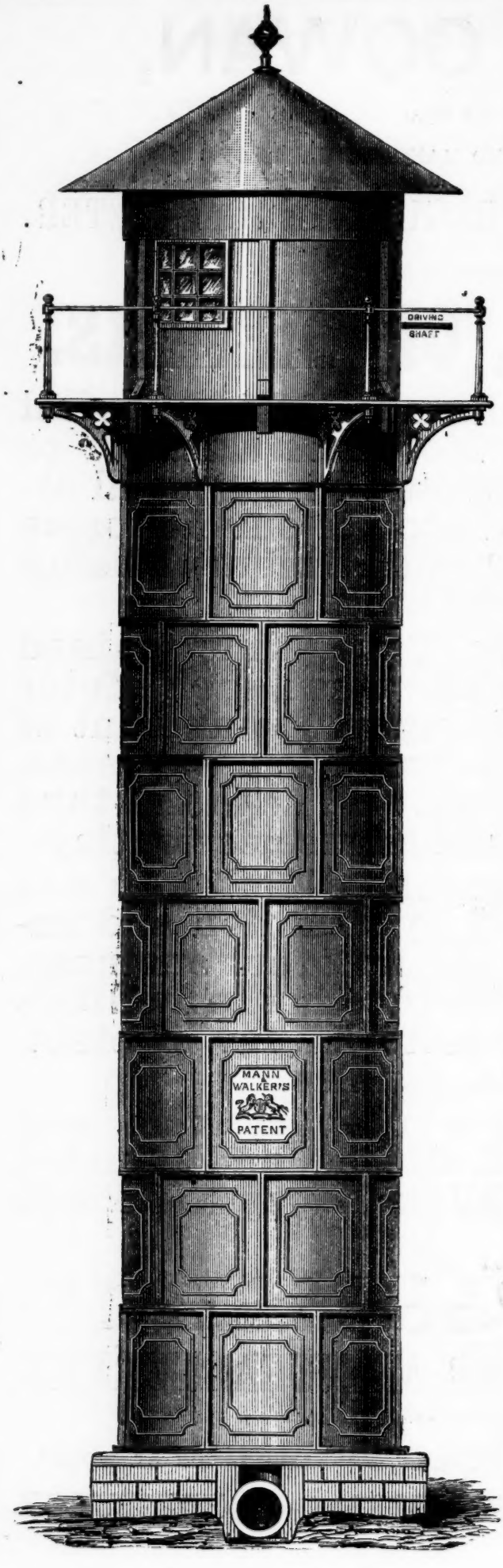
(ESTABLISHED 1827,)

CHURCH STREET, MILLBANK STREET, LONDON, S.W.	FENNEL STREET, MANCHESTER.	BUCCLEUCH ST. WORKS, EDINBURGH.



C. & W. WALKER,
8, FINSBURY CIRCUS,
LONDON, E.C.

MANN & WALKERS' PATENT SCRUBBER.

By Letters Patent in Great Britain, Europe, and the United States of America.

By some important improvements recently patented, the purifying power of these Scrubbers has been much increased, and a stronger ammoniacal solution obtained, which is found to absorb a large portion of the carbonic acid contained in gas, effecting an important saving in money and labour in the lime purifiers, and where oxide only is used, the increase in the illuminating power of the gas obtained by these Scrubbers is shown in a remarkable degree, in consequence of the large quantity of carbonic acid removed from the gas.

It is to be particularly noted that the important results of these Scrubbers do not depend upon the machinery alone. The entire internal construction of the Scrubber bears an almost equally important part. For this reason, where it is desirable to convert existing Scrubbers, whose dimensions happen to be suitable, the work commences by ripping out the whole of the interior of the shell, and beginning the internal construction *de novo* from bottom to top.

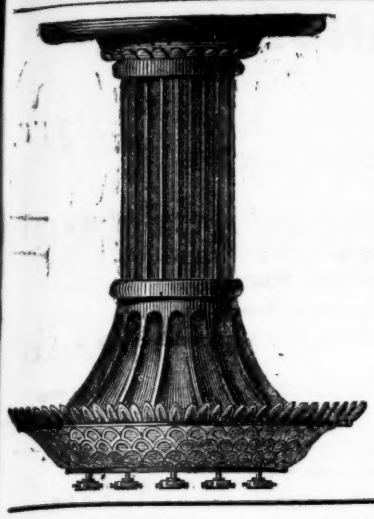
They are, in all cases, constructed under guarantees to perfectly perform their work. They are now extensively used in the largest gas-works of London and the chief cities of Europe, the number in use exceeds **one hundred,** and their perfect efficiency and profit to a gas company have been fully established with every variety of coal used in Europe. References can be given to the largest gas-works in Europe.

By their use the department of purification from ammonia upon a gas-works is made complete, without the aid of prepared oxide of iron, chemicals in purifiers, or any other supplementary process, and the whole ammoniacal residual product contained in the coal is absorbed and obtained in the form most profitable to a gas company, while the requirements of all Acts of Parliament and of the Board of Trade, relating to incorporate gas companies, are satisfied.

Foul Gas, properly condensed, entering the inlet is, by once only passing through the Scrubber, completely purified from ammonia with regular certainty day by day, without any further trouble, or any other process, effected by a very small quantity of clear water let into the machinery room at the top of the Scrubber, which is discharged at the liquor outlet at the bottom, from Newcastle coal at about 18 to 20 ounces strength, from Yorkshire and other coals, generally from 25 to 30 ounces strength; while acidulated litmus or turmeric exposed at the Scrubber outlet will not show the slightest discoloration, and there is not a quarter of a grain of ammonia per 100 feet left unabsorbed.

They contain their own engine power, requiring only a small inappreciable quantity of steam from the gas-works boiler, and are then complete in themselves, ready for service.

Applications relating to dimensions and prices should be addressed to us, C. AND W. WALKER, 8, FINSBURY CIRCUS, LONDON, E.C., or to Mr. WILLIAM MANN, late Superintendent of the Chartered Gas-Works, BLACKFRIARS, LONDON; they should state approximately the largest make of gas in 24 hours on a winter's day, and the smallest make on a summer's day, to be purified.



HENRY GREENE & SON,

GAS AND HOT WATER ENGINEERS,

155, CANNON STREET, E.C.

Manufactory: 19 & 20, NICHOLAS LANE, E.C.

SUN-BURNERS,

With Regulating Valves to obviate down draught.

MEDIÆVAL & OTHER GAS-FITTINGS

For Churches and Domestic Use.

ARCHITECTS' OWN DESIGNS WORKED OUT.

ESTIMATES FREE OF CHARGE.

THE TRADE SUPPLIED.

SOLE CONSIGNEES FOR BRÖNNER'S IMPROVEMENTS IN GAS LIGHTING.

IN THE MATTER OF

BRÖNNER'S GAS-BURNERS.

HENRY GREENE AND SON, 155, Cannon Street, London, Sole Agents for Great Britain, Ireland, and Colonies, of Brönner's Improvements in Gas Lighting, beg to inform the public that on the 13th of January, 1876, Julius Brönner obtained an injunction in the Court of Session, Scotland, against Donald M'Vean, Gas-Fitter, 14, Newton Street, Glasgow, prohibiting him from in any way advertising or offering for sale as Brönner's Burners, any Burner not manufactured by Julius Brönner, or from in any way inducing the public to believe that the said Donald M'Vean sells or keeps for sale Brönner's Burners, manufactured by Julius Brönner, while such is not the case.

Also that on the 9th of November, 1875, he obtained injunction in the same Court, and in the same terms, against R. M. Brechin and Co., 46, North Hanover Street, Edinburgh.

Also that on the 20th of April, 1875, in a suit in Chancery, before Vice-Chancellor Malins, number 1874, B 365, he obtained injunction against another defendant, in the same terms and on similar grounds.

WEST'S GAS IMPROVEMENT COMPANY, LIMITED,

ARE NOW PREPARED TO SUPPLY AND ERECT THEIR PATENTED MACHINERY FOR

CHARGING AND DRAWING GAS-RETORTS,

And to enter into arrangements with GAS COMPANIES for its use upon moderate terms of Royalty.

The Patented Machinery has secured the approbation of all Engineers who have visited the MAIDSTONE GAS-WORKS, *where it is in full operation, and may be inspected at any time on application to the Manager.*

The advantages attending its use are—

INCREASED VOLUME OF GAS PER TON.—INCREASED YIELD PER RETORT.—INCREASED BULK OF COKE FOR SALE.—REDUCTION IN LABOUR AND LESS DEPENDENCE ON SKILLED STOKERS.

A Pamphlet containing a description of the Machinery, and Copies of Reports on the working of the same, &c., will be forwarded on application to the MANAGING DIRECTOR, Maidstone. Communications may also be addressed to the Consulting Engineer, R. P. SPICE, Esq., M. Inst. C.E., 21, Parliament Street, London, S.W., or to the Engineer and Analyst, F. W. HARTLEY, Esq., A. Inst. C.E., 55, Millbank Street, London, S.W.

MESSRS. NEWTON, CHAMBERS, & CO.,

THORNCLIFFE IRON-WORKS, NEAR SHEFFIELD,

MANUFACTURERS OF

IMPROVED CENTRE-VALVES,

PURIFIERS, CONDENSERS, SCRUBBERS, GASHOLDERS, ROOFS,

And every description of Gas Machinery.

TENDERS GIVEN FOR WORK FIXED COMPLETE IN ANY PART OF THE KINGDOM.

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THE DERBYSHIRE

SILKSTONE COAL COMPANY, LIMITED,

CAN OFFER A

GAS COAL

Of superior quality, delivered at any station in England and Wales.

Purified gas per ton of coal in cubic feet (average)	**10,775**
Weight of coke in lbs. per ton of coal	**1,465**

ANALYSIS AND PRICES ON APPLICATION TO

Mr. EDMUND TAYLOR, Secretary,

ALBERT COLLIERY, NEWBOLD, NEAR CHESTERFIELD.

THE
SILICA FIRE-BRICK CO.,
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Near SHEFFIELD,
Manufacturers of THE ORIGINAL SILICA OR DINAS FIRE-BRICKS. Specially adapted for Gas-Retort Furnaces, and for Siemens's Gas-Furnaces. Shipments promptly executed to London, Liverpool, Hull, Grimsby, &c.

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Manufacturers of GAS-RETORTS, GLASS-HOUSE FURNACE & BLAST-FURNACE BRICKS LUMPS, TILES, and every description of FIRE-BRICK.
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Manufacturers for Home and Export.
GAS-RETORTS, GLASS-HOUSE FURNACE,
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And Every Description of Best Fire-Bricks.

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BEST STOURBRIDGE FIRE-BRICKS, LUMPS, AND CLAY RETORTS
Of all Dimensions for Gas-Works,
GLASS-HOUSE POTS & CRUCIBLES
Of every kind.
The Highest Award was obtained by H. & M., at the Philadelphia Exhibition, 1876, for Superior Quality of Manufacture.

SZERELMEY STONE LIQUID,
Which waterproofs and casehardens every kind of masonry, and
SZERELMEY IRON PAINT,
"The only permanent preservative against rust," having enjoyed the approval of the most eminent authorities, including SIR CHARLES BARRY, SIR R. I. MURCHISON, PROFESSOR FARADAY, "THE TIMES," "PALL MALL GAZETTE," "ENGINEER," "BUILDING NEWS," "IRON," &c.
MESSRS. SZERELMEY & CO.
Need only offer to send prices and particulars, and to advise correspondents how to treat special cases. Address
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PREVENTS WASTE OF GAS FROM RETORTS;
SAVES CLAY RETORTS FROM DESTRUCTION BY FIRE;
GREATLY ECONOMIZES THE USE OF FIRE-BRICKS;
And PREVENTS ALL POSSIBLE LOSS of GAS FROM LEAKAGE.
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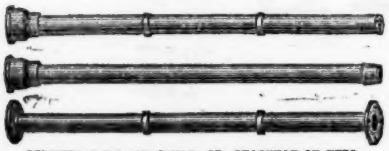
GAS AND WATER PIPES.
WILLIAM MACLEOD & CO.,
18 & 20, ALSTON STREET, GLASGOW.
CAST-IRON GAS AND WATER PIPES.



DELIVERY F.O.B. ON CLYDE, OR STOCKTON-ON-TEES.
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PATENTEE and MANUFACTURER of the following Inventions:—
RETORT SETTINGS—giving great Economy of Fuel.
STEAM-ENGINES and EXHAUSTERS, FOUR-WAY VALVES.
FUEL-MACHINE, for Compressing Breeze and Tar.
WASHERS, SCRUBBERS, and PURIFIERS, that Economize Space and Cost.
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ESTIMATES FOR GAS-WORKS OF ANY SIZE.
REFERENCES TO 500 WORKS ALREADY ERECTED.
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MANN & OWENS' PATENT GAS-VALVE.

EVERY VALVE WARRANTED TO BE PERFECTLY SOUND AND GAS-TIGHT.

VALVE, with Indicator for Above Ground. UNDERGROUND VALVE.

The advantages of this Patent Valve over all others yet introduced are, that it is always as tight as the best wedge or spring valve, without the possibility of setting fast or becoming suddenly leaky. The surfaces not being in contact during the operation of opening or closing, leakage through wear and tear is avoided.
The Gas Engineer will not fail to see the importance of such a valve in connexion with his purifying apparatus, particularly in the case of large sizes.
The slide being operated either by a screw and nut, or by a pinion and rack, a cam bearing upon a plane, cast on the back of the Valve, forces it against the face, and renders the escape of gas an impossibility. By a slight turn of the pinion or screw, the slide is released, and brought away from the face, by which means friction is avoided, and the only force required to open the Valve is that due to its own weight.

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Yields 12,500 cubic feet of 34-candle gas per ton, and 9 cwts. of excellent coke, containing only 4 per cent. of ash.

MUIRKIRK, No. 1, CANNEL
Yields 12,160 cubic feet of 32·5-candle gas per ton, and 10 cwts. of excellent coke, containing only 5 per cent. of ash.

OLD WEMYSS CANNEL
Yields 13,320 cubic feet of 32·5-candle gas per ton.
Prices and full Analyses on application.

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POPE & PEARSON, LIMITED, have now the authority of several of the most eminent Gas Engineers of London in stating that their Coal yields *in practical working over* 10,000 *cubic feet of gas, with an illuminating power of* 16 *candles;* or by the standard burners now used by the London Gas Companies, an illuminating power equal to 17½ candles.

One ton yields 12¼ cwt. of good coke. This Coal can be shipped from Hull, Goole, Liverpool, Morecambe, and Barrow.

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PLUTONIC CEMENT,
For Jointing and Repairing Retorts and Ovens both in and out of Action.
Used in the principal London and Provincial Gas-Works as a great aid to the economical production of Gas.
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GAS ENGINEER.
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Established 1840.

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T. Stone, Esq., of Weymouth, writes on Nov. 17, 1876: "I have used about 12,000 tons of this Coal, with, I think, the best possible results, although not always under the most favourable circumstances. My Coal account made up to Midsummer last showed a makeage of 10,524 cubic feet per ton of 14¼-candle gas, and not a hundredweight of Cannel used. This statement would, I know, be incredible to many men, and may provoke the remark, 'How much of it is paid for?' For the gratification of such, I have to say that, of the above quantity, 9866 cubic feet per ton of Coal carbonised were brought to charge and duly paid for, with the exception of about 6s. per cent. for bad debts. The coke is of excellent quality. The above facts I hold to be a greater recommendation to your Coal than any words of mine could be."

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Supply to any Railway Station Best Wigan Arley Gas Coal and Nuts; best qualities of the Derbyshire, Yorkshire, and North Staffordshire Gas Coals and Nuts; also the best descriptions of Lancashire, Welsh, Scotch, and other Cannel.

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Delivery per Rail to any Part.

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REAL OLD SILKSTONE GAS COAL.

JAMES PATERSON, Esq., Gas Engineer, of the Warrington Gas Company, reported, Aug. 10, 1875:—

"This Coal possesses remarkable qualities as a gas and coking coal, and appears SECOND TO NONE IN THE KINGDOM. It contains the large quantity of 699 lbs. of illuminating matter, and 1498 lbs. of coke to the ton, and produces **12,240** cubic feet of 16·66 candle gas."

The above Company are raising nearly a thousand tons of the Real Old Silkstone Gas Coal per working day.

PRICES QUOTED TO ANY RAILWAY STATION, OR F.O.B. HULL, GRIMSBY, GOOLE, KEADBY, LIVERPOOL, AND FLEETWOOD.

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THORNCLIFFE IRON-WORKS AND COLLIERIES,
NEAR SHEFFIELD,

STRONGLY RECOMMEND A TRIAL OF THEIR

CELEBRATED SILKSTONE GAS NUTS.

Analysis by F. J. EVANS, Esq., Chartered Gas Company, Horseferry Road, Westminster:—

(COPY.)

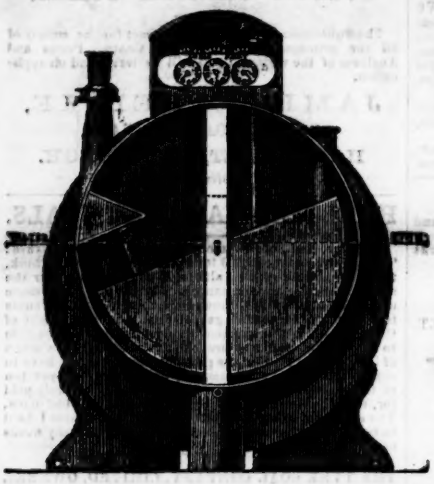
	Cubic Feet of Gas per Ton of Coal.	Illuminating Power in Candles.	Coke per Ton of Coal used.	Ash in Coke, per Cent.	Sulphur in Coal, per Cent.
Silkstone Nuts . . .	10·800	15·85	12·66 cwt.....	6·0	0·69

NOTE.—The illuminating power of the gas was tested by the standard burner now used in London by the Gas Referees, under the City of London Gas Act, 1868.

Horseferry Road, Westminster, March, 1870. (Signed) F. J. EVANS.

These Nuts are extensively used by various Gas Companies throughout the Kingdom, who bear strong testimony to their value.

APPLICATIONS FOR PRICES, &c., TO BE SENT DIRECT TO THE COLLIERY, AS ABOVE.



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"Unquestionably the best Water Gas-Meter now in use."—THOS. G. BARLOW, C.E.

Over 120,000 in action.

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GAS-RETORTS, LUMPS, TILES, & FIRE-BRICKS,

OF EVERY DESCRIPTION.

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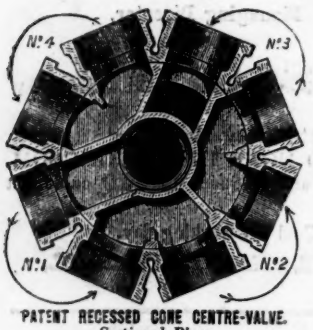

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Sectional Plan.

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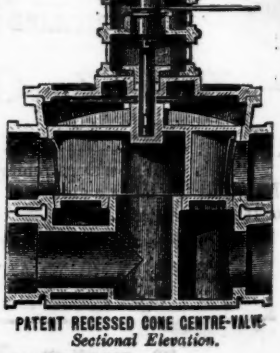
Constructed on the principle of the ordinary Plug-Cock.

THROUGH-WAY & FOUR-WAY COCKS

Of all descriptions.



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Sectional Elevation.

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Invite the attention of Gas Companies, Corporations, and others to their

PATENT STREET LAMPS,

Which are so constructed that neither putty nor other materials are required to secure the glass. No hacking out of old putty, which frequently destroys the frames. A new pane of glass can be inserted in two or three minutes by any inexperienced person, the glass being secured by a hinged flap and turn button.

PRICE 10s. each, net. Special quotations for large quantities.
Also made EXTRA STOUT recommended for its durability, PRICE 11s. 6d. each.

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By the use of which stoppages in service and other pipes are freed from naphthaline and other obstructions in a few minutes. PRICE 73s. net.

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For inserting in mains, to prevent the excess of pressure in high ground, or other elevated positions.

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